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14. ABSTRACT

Overweight and obesity form the basis of the second leading cause of preventable death in the United States and are on the rise (NIH, 1998). Traditionally, recommendations for weight loss include a reduction in dietary fat (Drewnowski, 1990). However, adherence to low-fat diets remains a challenge. Hedonic responses to food may be important to understand the adherence problem. When compared to bland-tasting foods, nutritionally-equivalent foods that are flavorful are more satiating (Rolls, 1995; Warwick et al., 1993). Two previous studies that examined the sensory impact of dietary fat modification reported conflicting results (Mattes, 1993; Guinard et al., 1999). The current study evaluated the impact of dietary fat modification on fat preference in three weight loss groups. The impact of changes in fat preference on shortterm adherence to a 6-week weight loss program was assessed. Sixty-one otherwise, healthy overweight women (BMI 25-37 kg/m2) between the ages of 18-60 were randomly assigned to one of three brief, 6-week weight loss programs. All three groups were asked to reduce dietary intake to 1800 kilocalories per day, but one group was asked to maintain fat at 36%, and two additional groups were asked to consume 20-25% of kilocalories in fat. One low-fat group was instructed to use fat substitutes and the other was instructed to avoid substitutes. It was hypothesized that decreased fat intake and sensory exposure to fat would cause a decrease in preference for high fat foods. Excellent adherence was observed with over 91% of participants completing treatment. In addition, guidelines regarding kilocalories, respective fat intake, fat substitute use were followed. Taste changes that occurred were subtle and did not affect on short-term dietary adherence. More time on the prescribed fat levels might be required to induce a change in fat preference. Differential changes in fat preference following dietary fat modification were expected, but not observed in the current investigation. However, results suggest that a modified 6-week Behavior Choice program might be a viable treatment option for women in this age and weight category (BMI < 37 kg/m2).

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ABSTRACT

Title of Dissertation: The impact of a low-fat diet and the use of fat substitutes on fat preferences among overweight women seeking weight loss treatment

Name, Degree, Year: Kimberly L. Kalupa, Ph.D., 2002

Thesis Directed by: Tracy Sbrocco, Ph.D., Associate Professor, Medical Psychology

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RUNNING HEAD: DIETARY ADHERENCE AND FAT PREFERENCE

The impact of a low-fat diet and the use of fat substitutes on fat preferences among overweight women seeking weight loss treatment

by

Kimberly L. Kalupa, M.S.

Dissertation submitted to the Faculty of the Medical Psychology Graduate Program

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This project is dedicated to Lt. Sandra King Young, M.S.

She lived with intention and died with grace and will remain in my heart always.

It was an honor to have known her.

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INTRODUCTION

Overweight and obesity form the basis of the second leading cause of preventable death in the United States and are on the rise (NIH, 1998). According to the Centers for Disease Control, the combined effects of dietary factors and sedentary behaviors account for at least 300,000 deaths each year (McGinnis, & Foege, 1993). Prevalence of overweight, defined as a body mass index (BMI) between 25-29.9 kg/m^2 in men and women increased from 30.5 to 32% between 1960 and 1994 (NIH, 1998). Even more dramatic, the prevalence of obesity (BMI >30 kg/m^2) increased from 12.8 to 22.5% during that same time frame (NIH, 1998). Fortunately, many of the risks associated with overweight and obesity can be reduced if small to moderate (10%) weight loss is achieved (NIH, 1998).

Over the past two to three decades, behavioral programs have successfully promoted clinically significant weight losses. Unfortunately, the maintenance of these losses are rather dismal, with more than 30-40% of lost weight regained within one year for men and women who underwent behavioral treatment of obesity (Perri, 1998). Two to five-year follow-up of behavioral treatments for obesity indicate a gradual, but nearly certain return to baseline weights (Kramer, Jeffery, Forster, & Snell, 1989; Stalonas, Perri, & Kerzner, 1984; Wadden, Sternberg, Letizia, Stunkard, & Foster, 1989). Perri (1998) reviewed the efficacy of techniques added to improve maintenance of losses achieved by traditional behavior therapy, and concluded that weight regain still remains probable upon program termination. As depicted in Table 1, weight regain occurs despite longer programs and new program components (Wing, 1999).

One exception to this phenomenon is the Behavioral Choice Treatment (BCT) proposed by Sbrocco and colleagues (Sbrocco, Nedegaard, Stone, & Lewis, 1999; Sbrocco, Lewis, Stone, Nedegaard, Kalupa, & Vaughn, 2001). Unlike traditional behavior therapy approaches to weight

loss, BCT promotes continued weight loss even at a two-year follow-up (Sbrocco et al., 1999, Sbrocco, Lewis, Stone, Nedegaard, Kalupa & Vaughn, 2001). The BCT approach is a cognitive-behavioral approach based on a decision-making model of women's food choice that emphasizes the need to understand factors controlling eating behavior (Sbrocco, et al., 1999). Jeffery and colleagues (2000) proposed that taste and hedonic properties of food might influence food choices among overweight.

The current investigation examined the effect of dietary modification on the hedonic experience of certain foods among overweight women in a brief, 6-week, weight management program. The subsequent pages review several areas of literature that are pertinent to the current investigation. First, the importance of taste in dietary modification is discussed and factors that contribute to the over consumption of fat in the American diet are reviewed. Next, the health benefits of a low fat diet and obstacles to adopting a low fat diet are reviewed. Approaches designed to improve adherence to low fat diets are also reviewed. After discussing the benefits, challenges, and factors relevant to dietary adherence, one factor that affects dietary adherence, taste, is discussed in greater detail.

Differences in taste preference and taste perception between overweight and normal weight women are reviewed. An overview of taste-related parameters and their applicability to the study of obesity are presented. In addition, studies that examined the impact of dietary modification and the impact of sensory exposure to fat on the hedonic experience of fat are reviewed in greater detail and the rationale for the current investigation are presented.

The Importance of Taste in Dietary Modification

Traditionally, weight loss programs recommend dietary modification through caloric restriction and modification of macronutrient composition. It has been suggested that the

problem of obesity could be ameliorated if fat intake is markedly reduced because of the resulting reduction in total energy consumption (Mattes, 1998). Taste-related parameters are particularly important to treat obesity because weight reduction programs may significantly affect taste. Low-fat diets have been heralded as a means for individuals to lose and maintain body weight without "depriving" themselves of the overall experience of eating. This approach capitalizes on the thermic effect of food and the differences in energy density of fat versus carbohydrate. Each gram of fat contains 9 kilocalories, whereas each gram of carbohydrate contains 4 kilocalories. An 1800-kilocalorie diet that is high in carbohydrates allows individuals to consume more food volume than an 1800-kilocalorie diet that is high if fat. However, reducing dietary fat can significantly alter a diet's palatability (Drewnowski, 1990; Grundy, Brown, Dietschy, 1989). Given that maintenance of weight loss remains the exception, the relationship of palatability to dietary adherence warrants further examination. Several questions regarding the reinforcement value of food and the role of palatability in the etiology and maintenance of obesity remain.

Factors Contributing to Fat Over-consumption and Obesity

In the U.S., lifestyle factors have contributed significantly to the development of obesity. Advances in technology have encouraged many Americans to adopt sedentary lifestyles in the context of an environment where high fat, highly palatable foods are readily available. Currently, the average adult American diet consists of between 34-38% fat (CDC, 1994; Harnack, Jeffery & Boutelle, 2000). Data from the United States Department of Agriculture (USDA) indicated that Americans are consuming record high amounts of some high-fat dairy products and near record high amounts of added fats including salad oils and cooking oils, and fats used for frying (USDA, 1998). Even though Americans consumed more meat in 1994 than

in 1970, the proportion of fat in the U. S. food supply contributed by meat, poultry, and fish dropped from 35% in 1970 to 24% in 1994 (USDA, 1998). Similar amounts of meat were consumed in 1997 and 1994. In both 1994 and 1997, the reduction in fat from meat sources, despite the increase in consumption, was explained by the consumption of leaner meats (USDA, 1998). Between 1970 and 1997 there was a 26% increase in per capita consumption of added fats and oils (USDA, 1998). Among women aged 19-50, the single largest source of dietary fat is salad dressing (USDA, 1998). These data indicate that the contribution of added or discretionary fats to fat in the American diet is significant. For this reason discretionary fats are the focus of the current investigation.

Despite current understanding of the health benefits of a lower fat diet, dissuading individuals from choosing high fat foods is difficult. Food choices ultimately depend on some complex combination of hedonic factors, cognitive factors, sensory factors, physiological needs, powerful instinctive tendencies, and acquired habits (Young, 1977). Some food preferences, like preference for sweet tastes, are innate, whereas preferences for other flavors develop as a function of repeated exposure and experience (Hetherington & Rolls, 1996). From an evolutionary perspective, the taste-related factors that developed to direct humans to consume safe foods and to obtain sufficient energy now may contribute to the problem of overweight. Sensitivity to sweet tastes may have developed to help humans identify high-energy (carbohydrate based) foods (Young, 1977). Sensitivities and preferences also may have developed for tastes other than sweet to enhance survival. Given the relative caloric density of fat (9 kilocalories/gram) compared to carbohydrates (4 kilocalories/gram), sensitivity to fat might have even greater evolutionary value for survival. This “caloric advantage” has been hypothesized to contribute to a fat preference (Schiffman, Graham, Sattely-Miller, & Warwick,

1998). Unfortunately, sedentary lifestyles have reduced the average energy needs of American adults and excess kilocalories contribute to the problem of obesity.

Health Benefits of a Low-fat Diet

Consumption of a high fat diet can result in several negative health outcomes including coronary heart disease, various types of cancer (breast, colon, and prostate), obesity, and Type 2 diabetes (Mattes, 1998). Risk for cardiovascular disease has been significantly associated with dietary fat intake (American Heart Association Task Force on Cholesterol, 1990; Grundy, 1986; La Rosa et al., 1990). Low-fat diets (< 30% of total caloric intake) result in positive physical health or risk reduction. Lower fat diets are associated with weight loss, which has clear implications for obesity, hypertension, and insulin resistance. In addition, reductions in dietary fat are associated with improved glycemic control among diabetics (Schafer et al., 1997). Similarly, low-fat diets are also associated with reduction in risk for cardiovascular disease (e.g., Kris-Etherton et al., 1988), and several types of cancer (e.g., Beresford et al., 1997; Schapira, Lyman, Kumar, & Baile, 1991). As a result of the benefits associated with low-fat diets, several organizations (including the office of the U.S. Surgeon General, U.S. Department of Health and Human Services, Nutrition Research Council of the National Academy of Sciences, the American Heart Association, American Diabetes Association, and the American Cancer Society) have all produced dietary guidelines that recommend the consumption of less than 30% of total kilocalories in fat, for all individuals older than 2 years (Mattes, 1998).

Adherence to Low-fat Diets

Despite clear benefits of a low-fat diet and the recommendations of professional organizations, low-fat diets are notoriously difficult to adhere to and maintain (Drewnowski, 1990). The majority of nutrition education programs require high levels of literacy skills and

target middle-income Caucasian individuals (Winkleby et al., 1997). Few low-fat dietary interventions have targeted low-income, ethnically diverse populations that are at greater risk for literacy problems and obesity (Winkleby et al., 1997). Several behavioral and psychosocial interventions have attempted to increase adherence to low-fat diets in adults (e.g., Perri, 1998). A variety of interventions and evaluation techniques have appeared in dietary adherence literature and are reviewed below. The studies reviewed examine healthy volunteers, individuals at risk for specific diseases, individuals in the early stages of disease, and individuals who are attempting to prevent relapse of specific diseases. The review is organized by diet components and participant characteristics that may impact dietary adherence.

Palatability and Dietary Adherence

One obstacle to the adoption of a low-fat diet is the decreased food palatability associated with the removal of fat (Drewnowski, 1990; Grundy, Brown, Dietschy, 1989). That is, food is eaten for more than nutritive purposes and the taste of food is one important aspect of eating. Food that is less palatable is probably less reinforcing. This loss of reinforcement is one possible reason that a low-fat diet is so difficult to initiate. Once initiated, however, it is possible that a low-fat diet may be maintained.

Although reduced palatability makes it difficult to adopt a low-fat diet, it is important to consider the impact of a low-fat diet on taste perception and taste preference over time. The Women's Health Trial (WHT) was a large multi-center trial that was designed to determine if reduced dietary fat would reduce the risk of breast cancer among approximately 2000 healthy women aged 45 to 69 (Henderson et al., 1990). Inclusion criteria for the WHT included an increased risk for breast cancer (based on a family history of breast cancer, no or late first pregnancy or a history of a benign breast biopsy). After the Women's Health Trial was

discontinued, 525 of the women who had been randomly assigned to the low-fat condition during the original study were randomly selected to participate in a follow-up study designed to examine the degree to which dietary changes were maintained. One of the goals of the follow-up study was to examine the relationship between adherence to a low-fat diet and taste perception (Urban, White, Anderson, Curry, & Kristal, 1992). A food frequency questionnaire was mailed to each participant and 85% of the women completed and returned the questionnaire. Among the 448 responders, the average reported fat intake was 40.0% at baseline, 26.6% at the end of the trial, and 27.7% at follow-up (mean length of follow-up was 12 months). Over 50% of the participants reported that they developed an actual "distaste" for fat during the low-fat dietary intervention (Urban et al., 1992). Structural equation modeling revealed that the development of a "distaste" for high fat foods was strongly associated with adherence during the dietary intervention. In addition, even though the relationship between the development of "distaste" for fat and the maintenance of a low-fat diet was not statistically significantly, there was a trend in this direction (Urban et al., 1992). Unfortunately, the reasons for adherence were assessed retrospectively, and may represent biased information (Urban et al., 1992). For example, individuals might have been attempting to reduce cognitive dissonance by saying that if they ate a low-fat diet, they must have liked it (Festinger, 1957). A well- designed prospective study would help to clarify the impact of a low-fat diet on palatability and adherence.

One key question that remains is the impact of fat substitutes on palatability. According to the American Dietetic Association (ADA), fat substitutes are not chemically classified as fat, but instead are products designed to mimic the sensory and functional properties of fat (Mattes, 1998). Fat substitutes were developed to enhance diet palatability in reduced fat foods without adding caloric density (Mattes, 1998). In the follow-up study to the Women's Heart trial,

perceived deprivation, with respect to food choices, was the strongest reported deterrent to the maintenance of a low-fat diet (Urban et al., 1992). Fat substitutes might prevent or minimize the loss of reinforcement from eating a low-fat diet. The relationship between fat substitutes, fat preference, and perceived palatability of foods should be examined further.

In one prospective study of healthy adult volunteers, adherence to a moderate reduced (20-25%) fat diet for 12 weeks led to a reduction in hedonic ratings for high-fat foods when fat substitutes were avoided (Mattes, 1993). It is interesting that after the termination of the diet, despite hedonic shifts, participants returned to baseline levels of fat intake (Mattes, 1993). It can be argued that fat substitutes should not be used because they maintain exposure to fat-like characteristics and, therefore, may prevent hedonic shifts. Results from Mattes (1993) indicated that hedonic shifts might be insufficient to increase adherence to low-fat diets, and the author subsequently argued for the use of fat substitutes to enhance the palatability of a low-fat diet. One potential confound in the Mattes (1993) study is that one of the intervention groups had an average BMI of 26 kg/m^2, which is overweight according to NIH guidelines. Although BMI differences between the intervention groups were not statistically significant, the total sample size was small ($n = 27$), and it is possible that with a larger sample this difference would reach statistical significance. Research should examine the role of dietary modification on fat preference within a clearly defined sample and with sufficient statistical power.

Another study that examined the impact of dietary modification on fat preference was the Dietary Effects on Lipoprotein and Thrombogenic Activity study (DELTA). The DELTA study was a large multi-center, controlled feeding study designed to explore the effects of dietary fat on plasma lipid and lipoprotein levels (Kris-Etherton et al., 1988). Participants in the DELTA study were randomly assigned to a sequence of three 8-week experimental diets that included the

"average American" diet (37% total fat), a diet that had 30% total fat and a diet that contained 26% fat (Kris-Etherton et al., 1988). In an ancillary study, before baseline and at the end of each diet intervention, 20-participants completed sensory tests that were designed to measure sensitivity and liking for fat in several foods (Guinard, Sechevich, Meaker, Jonnalagadda, & Kris-Etherton, 1999). No significant differences among the diets occurred for liking of fat in milk, muffins, cheese, mayonnaise, hot dogs, or pastries (Guinard et al., 1999). In addition, there were no significant differences among diets for sensitivity to fat using high fat and low-fat samples of milk, pudding, and soup (Guinard et al., 1999). After finding that percentage of dietary fat was not a significant determinant of either sensitivity or liking for fat, these investigators concluded that sensory factors should not be a barrier to the implementation of low-fat diets (Guinard et al., 1999). However, the ancillary DELTA study used a small sample (n=20) and might have lacked adequate statistical power to detect group differences. In addition, participants in the DELTA study received all foods from a cafeteria, where all foods were prepared and served. Research should consider using a more naturalistic setting so that findings may be more easily generalized.

In summary, with regard to prospective studies examining palatability, hedonic shifts occurred in response to low-fat diets in one study (Mattes, 1993), but not in the other (Guinard et al., 1999). Differences in methodology, including length of intervention, structure of the programs, and degree of fat restriction may explain differential findings. The dietary intervention in the Mattes (1993) study was 12 weeks long (although the hedonic shifts were seen as early as 4 weeks) and 8 weeks long in the DELTA (Guinard et al., 1999) study. Neither intervention provided consistent and intensive support, nutrition education, or behavior modification. In the DELTA study, individuals were simply required to eat the foods that were

provided at the feeding centers, but nutrition education and behavior modification (beyond techniques used to enhance adherence to the protocol) were not utilized. More of these factors were included in the Mattes (1993) intervention, as monthly meetings were held where individuals received feedback about their adherence to their prescribed diet (based on 24-hour recall) and they were given an opportunity to have general questions answered.

Additionally, the level of fat restriction differed between the two studies. In the Mattes (1993) study, individuals were instructed to reduce their intake of dietary fat to 20-25% of their total caloric intake, whereas the DELTA intervention required reductions in dietary fat to either 30%, or 26% of their total caloric intake. That is, the reduction of dietary fat in the DELTA study may not have been sufficient to create hedonic shifts. Individuals in the Mattes (1993) study had differential, although statistically insignificant, changes in kilocaloric intake across the intervention groups. For example, individuals in the two intervention groups lost an average of 2 kg over the course of the intervention, whereas individuals in the control condition gained an average of 0.8 kg (Mattes, 1993). In the DELTA study, individuals were prescribed a kilocalorie level based on nutritional needs to maintain their weight and did not show significant weight loss across the intervention. Corwin (2000) recommended that future research examine the effects of reduced fat in the absence of overall energy deprivation to tease apart some of these factors. However, another strategy would be to partially replicate Mattes' (1993) study using a similar methodology and to examine within-group differences. That is, the impact of caloric intake and weight loss on fat preference could be examined within each dietary intervention group.

Other Program Characteristics Impacting Dietary Adherence

In addition to palatability, the impacts of other program characteristics on dietary adherence have been examined. Some of these program characteristics include nutrition

knowledge, the length of dietary invention, the intensity of dietary intervention, the level of patient involvement in program design, and the presence of social support.

Nutrition information has been described as a necessary but insufficient aspect of sustained dietary behavior change (Hochbaum, 1981). Recent dietary intervention studies have disseminated dietary information in a variety ways, ranging from group counseling (e.g., Schapira et al, 1991) to the distribution of self-help pamphlets (e.g., Beresford et al., 1997). Meta-analytic reviews of this literature have failed to find strong associations between nutrition knowledge and food intake (e.g., Axelson, Federline, & Birnberg, 1985; Shepherd & Stockley, 1987; Shephard & Towler, 1992; Stafleu, Van Staveren, De Graaf & Burema, 1996).

Wardle, Parmenter, and Waller (2000) argued that the relationship between nutrition knowledge and dietary behavior has not been adequately examined because nutrition knowledge has traditionally been measured with unreliable instruments. Additionally, these researchers held that studies examining the impact of nutrition knowledge on dietary behavior have been powered to find clinically significant differences, but may have ignored more modest differences. They note that even small differences could have a significant impact on health behaviors, if considered from a population-wide perspective (Wardle et al., 2000).

In a study that was part of a large postal survey (N= 1040) conducted in England, nutrition knowledge was positively correlated with healthy dietary behaviors (Wardle, Parmenter & Waller, 2000). Previous research had shown that the measure of nutrition knowledge that was used by Wardle and colleagues (2000) was psychometrically valid (Parmenter & Wardle, 1999). Results from the postal survey indicated that individuals who were most knowledgeable about nutrition were 25 times as likely as individuals who were not knowledgeable about nutrition to meet nutritional guidelines for fruit, vegetable, and fat intake (Wardle, Parmenter & Waller,

2000). The effects of nutrition knowledge were present after controlling for the effects of educational level and occupational category (Wardle et al., 2000). However, because the study examined only associations between nutrition knowledge and dietary behaviors, a causal relationship could not be determined (Wardle et al., 2000). This study suggests that a more fine grain examination of nutrition knowledge and its impact on dietary intake is worthwhile. The majority of dietary interventions have considered factors beyond nutrition information and the impact of several factors are described below.

The length of dietary interventions has been considered to be a potentially important variable in promoting treatment success. Schapira and colleagues (1991) examined the efficacy of brief dietary interventions on dietary habits one year after the interventions ended. Fat intake and caloric intake were compared across two separate brief (4 hour) interventions and a longer-term intervention (6 months) (Schapira et al., 1991). The brief interventions were called the Fork Wise interventions and the longer intervention occurred as part of the Women's Health Trial Feasibility study (Schapira et al., 1991). Participants who were eligible for the Fork Wise programs were randomly assigned to either a minimum intervention group (FW1) or a moderate intervention group (FW2). Both of the Fork Wise groups received a 2-hour psychoeducation session that emphasized how to make healthy food purchases, emphasized how to read nutritional labels, provided an overview of the risks of a high fat diet, and taught basic behavior modification for making dietary changes. In addition, individuals in the moderate Fork Wise intervention (FW2) received a list of specific behaviors that they were to engage in by the following week. At a second, 2-hour meeting held one week later, both of the Fork Wise groups were given a chance to discuss difficulties and problem solve. Significant immediate reductions in dietary fat consumption occurred in both the brief and the long-term interventions, but greater

long-term compliance occurred in the longer intervention (Schapira et al., 1991). These findings suggest that program length may influence dietary adherence. However, several potential confounds existed in the Schapira et al. (1991) study. Perhaps the most important potential confound was the fact that individuals in the longer intervention were at "greater risk" for breast cancer than women in the brief intervention groups. Therefore, it is unclear if increased compliance resulted from fear of disease outcome or length of intervention. In addition, given the vast difference in program duration (4 hours versus 6 months), several variables beyond program length differentiated the intervention groups including program intensity, degree of patient involvement, and the amount of feedback received by patient. It is difficult to draw clear strong conclusions about program length from this intervention. Research could compare different intervention lengths but hold other factors such as the health status of participants, and the type of nutritional information provided constant.

Another way that program length has been examined is through the addition of "follow-up" periods of the dietary intervention. One major dietary intervention that had reducing dietary fat among its aims was the Dietary Approaches to Stop Hypertension trial (DASH) (Windhauser et al., 1999a). DASH was a large clinical trial that found lowered blood pressure among individuals who made major dietary changes (Windhauser et al., 1999a). These dietary modifications included reductions in dietary fat, red meat, and sugar and increased consumption of fruits, vegetables, low-fat milk products, whole grains, nuts, fish, and poultry (Windhauser et al., 1999a). The DASH trial assessed the impact of three different dietary patterns on blood pressure in 459 free-living adults at four clinical sites. One important aspect of the DASH program was the emphasis on patient follow-up, which occurred either over the telephone or in person (Windhauser et al., 1999a). These encounters were used to reinforce dietary change and

to facilitate problem solving. However, all groups received follow-up and it was assumed that this addition improved adherence to a low-fat diet. Whether or not a follow-up period improves long term dietary adherence is an empirical question that could be tested in a study where some groups are randomized to treatment plus follow-up and other groups are randomized to treatment only.

The intensity of dietary interventions is related to the length of dietary inventions. Many dietary interventions are intensive in that they require participants to attend weekly or monthly sessions, they provide individualized feedback, and they include either individual or group counseling. One exception is the Eating Patterns Study, a randomized controlled trial that evaluated the value of self-help materials distributed in a health-care setting on decreasing dietary fat intake (Beresford et al., 1997). After an initial telephone screen that assessed fat intake, the intervention group was given a self-help booklet detailing healthful eating and physician endorsement. Self-tests were provided in the booklet to assess health practices and several motivations for adopting a low-fat diet were presented. A control group was phone screened and dietary intake was assessed, but no information was provided. A drop in fat intake from baseline was evident in the control and intervention groups post treatment, but greater changes occurred in the intervention group at 3 and 12-month post-treatment assessments (Beresford et al., 1997). Findings indicated that changes in fat intake could occur even in low intensity, public health-based interventions. These findings suggest that long-term dietary inventions may be unnecessary to promote some level of dietary fat reduction.

One limitation of the Eating Patterns study is the use of a food frequency questionnaire (FFQ) rather than food diaries. While a FFQ is a more convenient way to assess dietary intake, it fails to consider energy levels and requirements and is generally less accurate than more time-

intensive food diaries (Schaefer et al., 2000). However, because both the intervention and the control groups used the FFQ, it is unlikely that reported fat intake was more skewed in one group than the other. Therefore, these data may be useful to estimate relative amounts of fat eaten in the two groups, but may not accurately represent the actual amounts eaten.

The level of patient involvement in program development is an additional characteristic of program design that has been considered in examining dietary adherence. Nutrition education programs are typically developed without patient input. In a study designed to examine the impact of patient involvement in the development of their own one day dietary program, hyperlipedemic patients were randomly assigned to either a control condition, an expert-designed program, or a program designed based on patient feedback (Dobs et al., 1994). There were no changes in the control group or either of the intervention groups' dietary intake over a 3-month follow-up. These researchers concluded that a one-day intervention was insufficient to initiate dietary change (Dobs et al., 1994). Therefore, the impact of patient involvement in the design of dietary intervention has not been adequately examined.

Another component of dietary interventions that may impact adherence is social support. Bovbjerg and colleagues (1995) reported an absence of empirical work examining the role of social support among individuals using dietary change to lower lipid levels. However, a lack of social support has been associated with negative health outcomes for several chronic illnesses, including heart disease (Cohen, 1988). The mechanism by which social support influences heart disease is unknown, but it has been proposed that social support may encourage healthy behavior modification (Bovbjerg et al., 1995). That is, social support may help to alter risk factor status through changed behavior.

The impact of social support on dietary adherence was examined in the Dietary Alternatives Study (DAS) (Walden, McCann, & Retzlaff, 1991). The DAS reported the positive effects of reduced fat and reduced cholesterol diets on married, hyperlipidemic and hypercholesterolemic men (Walden, McCann, Retzlaff, 1991). A subgroup of the DAS participants who had completed both spouse support variables and food records at each assessment were selected to examine the role of social support on the consumption and maintenance of a low-fat diet (Bovbjerg et al., 1995). Diet instruction occurred over the course of 8-weekly sessions. Spouses were encouraged to attend the sessions and were actively involved in all phases of the program, including problem solving.

Despite apparent support, the men in this study reported a wide range of perceived support for their achievement of dietary goals (Bovbjerg et al., 1995). High levels of perceived diet-specific social support were associated with the achievement and the long-term maintenance of dietary fat intake (Bovbjerg et al., 1995). However, perceived social support at the end of the dietary intervention did not predict the achievement of end of intervention dietary goals, but did predict success at follow-up (Bovbjerg et al., 1995). Therefore, one potential benefit of social support during dietary intervention appears to be an increased ability to adopt and maintain long-term dietary changes.

In addition to factors considered in program design, specific techniques have been employed to enhance dietary adherence including the use of motivational interviewing and motivational enhancement. Motivational interviewing is a technique that is used to assess a client's readiness to make behavioral changes before they are selected to be participants in an intervention (Rollnick, Heather, & Bell, 1992). Data collected from a motivational interview can be used to either screen out "insufficiently motivated" individuals or to identify and provide

support for individuals who are at risk for drop out (e.g., Windhauser et al., 1999a). One dietary study that utilized motivational interview techniques was the Dietary Approaches to Stop Hypertension (DASH) trial (Windhauser et al., 1999a). In the DASH trial, successful patient adherence, defined by following dietary guidelines on 90% of study days, was achieved using motivational interviewing and motivational enhancement techniques. The DASH trial demonstrated the effectiveness of a healthy diet in lowering blood pressure and offered tips to ensure client adherence (Windhauser et al., 1999b). The leaders of this intervention reported that the recognition of ambivalence towards dietary change that exists in most patients was an essential step in the change process (Windhauser et al., 1999a). In the DASH trial, adherence was increased through the use of prescreening assess participant's level of commitment to dietary change and the through the use of motivational strategies throughout the program. Participants who were non-adherent during the baseline periods or who were identified as being at high risk for nonadherence were not allowed into the intervention. For participants who made it into the intervention phase, motivational interviewing to encourage participants to identify their own motives for and commitment to change were used to tailor the program to meet the individual's level of readiness (Windhauser et al., 1999a). Nutritionists and health care providers were taught to respond to client concerns and problems with non-judgmental feedback, and to help set and assess individual goals.

Motivational techniques were considered a crucial aspect of the overall DASH program success by creating an environment conducive to change and excellent levels of participant adherence were observed (Windhauser et al., 1999a). Although the DASH trial did not directly compare groups that received motivational interviews with groups that did not receive motivational interviews, it was assumed that this technique was an important factor to enhance

adherence. While achieving adherence to the program diets on 90% of study days is excellent adherence, it is unclear if the use of motivational techniques or some other factor enhanced adherence to this level in the DASH trial (Windhauser et al., 1999a). For example, one potential confound in the DASH study was that fact that meals were provided by the program. Free-living and eating adults might have had lower rates of compliance to a diet that they had to prepare (Vogt et al., 1999). Future research could examine the use of motivational interviewing as a separate independent variable in dietary adherence research to better understand its impact.

Another specific technique that has been employed to enhance dietary adherence is the use of dietary feedback in a variety of forms. Consistent and effective interventions for dietary intake require reliable food-monitoring techniques so that feedback can be provided to participants. The feasibility phase of the Women's Intervention Nutrition study (WINS) examined compliance with a low-fat diet among middle aged, mostly Caucasian women who were either at high risk for breast cancer or had actually undergone breast cancer treatment (Buzzard et al., 1996). Two hundred and ninety eligible participants were randomly assigned to a low-fat intervention or a control group that received no feedback about their dietary fat intake (Buzzard et al, 1996). A greater reduction in fat intake occurred for the intervention group than in the no feedback control group (Buzzard et al., 1996). Given the high risk for breast cancer in WINS participants, the results of this study may be difficult to generalize to less motivated populations.

Brug and van Assema (2000) compared the effectiveness of general nutrition information to individually-tailored computer feedback on dietary intake. Individually-tailored fat feedback was more effective than general nutrition information to encourage reduced fat intake, even among individuals with low motivation or little formal education (Brug & van Assema, 2000).

However, more dramatic and consistent fat reductions occurred for individuals who were highly motivated to change (Brug, & van Assema, 2000). Therefore, feedback that is specific to the individual participants and targets desired behavior change might be an effective component to enhance dietary adherence.

Useful dietary feedback is dependent on accurate self-monitoring data. It is impossible to help people change if it is unclear what their behaviors are. There are various methods of dietary self-monitoring including food rating scales, food frequency questionnaires, spontaneous dietary recall, and food diaries. Each of these methods has the potential to yield useful information, but each also has limitations. Buzzard and colleagues (1996) determined that individuals overestimated the extent of fat restriction when using food diaries relative to spontaneous recall at 6 and 12 months post intervention. The authors assumed that the spontaneous retrospective 24-hour recall would prompt more honest and accurate reporting than food diaries, but given the great variability that exists from day to day, one day of recall may not be representative of typical food intake (Buzzard et al., 1996). One of the unique strengths of the WINS study was the use of actual food diaries to measure intake (Buzzard et al., 1996). Prospective food diaries require less reliance on participant memory and require greater precision because quantities of food are measured (Buzzard et al., 1996).

In addition to food diaries and spontaneous food recall, other methods of self-monitoring have been evaluated. Food record ratings involve assigning various food items with fat scores that are eventually totaled. Food record ratings, as a monitoring technique, have been criticized because they fail to consider the type of fat (polyunsaturated, mono-saturated, etc.), they are consistent despite actual energy requirements of the individual, and the scoring is complex and difficult to teach to clients (Roy, Kimball, Mendoza-Martinez, Mateski, & Insull 1997). It has

been hypothesized that adherence would be greater in interventions using a more direct measure of fat intake, such as fat gram counting (Roy et al., 1997). Contrary to predictions, Roy and colleagues (1997) found that adherence was equal in groups utilizing fat gram counting and food-record rating techniques (Roy et al., 1997). These findings indicate that although different techniques might yield more accurate results, accuracy did not necessarily improve adherence.

Another technique that has been used to improve dietary adherence is relapse prevention. Relapse prevention refers to the addition of program components that specifically target the maintenance of behavior change. Over the past 15-years, relapse prevention techniques have been added to existing dietary protocols in an attempt to inoculate individuals against future nonadherence. Brownell and Cohen (1995a) reviewed relapse prevention techniques utilized in dietary change interventions and reported that the impact of relapse prevention on adherence is difficult to understand because it is rarely independent of other factors. Benefits of relapse prevention techniques like coping skills, the identification of high risk situations, and problem-solving have been shown in several studies examining adherence to dietary changes (Brownell & Rodin, 1990; Henderson et al., 1990). More research is needed to elucidate the relationship between dietary behaviors and relapse prevention techniques.

Participant Characteristics Impacting Dietary Adherence

Participant characteristics, including current behavior, psychosocial status, and willingness to change, influence dietary adherence. One approach frequently used to understand and improve dietary adherence is the identification of characteristics common to people who adhere and/or the identification of characteristics common to non-adherent individuals. Once these characteristics are identified, individuals can be selected or excluded from treatments based on their development or changing of relevant characteristics. For example, in the DASH trial,

participants were required to complete a pre-treatment program in order to screen out non-adherent individuals (Windhauser et al., 1999b).

Another way that personal variables have been used in dietary adherence interventions is to develop interventions specific to a sub-group of individuals. The Stanford Nutrition Action Program (SNAP) evaluated the efficacy of two classroom based nutrition programs on the reduction of dietary fat in a sample of 351 adults, 60% of whom were Hispanic (Winkleby et al., 1997). SNAP was a longitudinal examination of factors associated with the achievement and maintenance of a low-fat diet among individuals with low-literacy skills. The SNAP curriculum specifically targeted the reduction of dietary fat, but did not rely on written materials and was compared to a general nutrition (GN) program based on altering diets to meet the guidelines of the Food Guide Pyramid. Among the participants with a moderate initial fat intake (<60 grams), 60% of individuals in the SNAP program, but only 30% of GN participants, reduced their fat intake to <30% of total caloric intake at 3 months post intervention. Individuals with high baseline fat intake (>60 grams) were much less successful (Winkleby et al., 1997), indicating that baseline fat intake may be an important factor to consider when designing a low-fat dietary intervention. An effective treatment for individuals who consume a moderate amount of dietary fat may not be sufficient to meet the needs of individuals consuming high levels of dietary fat. A potential problem with the SNAP program was that it relied on a food frequency questionnaire (FFQ) instead of food diaries. Results of the SNAP intervention indicate the value of targeting interventions to sub-groups of individuals and to specific dietary goals, such as the reduction of fat. Future research should consider baseline fat intake as a potentially important factor in dietary adherence studies.

An additional characteristic of participants that influences long-term dietary adherence is dietary behavior during treatment. During a feasibility study for the Women's Health Trial, low-fat dietary habits were maintained for nearly 2 years after the end of the trial (Urban, White, Anderson, Curry, & Kristal, 1992). Adherence to the diet during the trial was significantly related to session attendance and predicted dietary behavior at follow-up (Urban et al., 1992). That is, individuals who had good adherence during the study were more likely to maintain dietary changes at follow-up. In the Working Well study, the factors that were most strongly associated with a reduction in dietary fat were baseline diet, past success at change, and motivation to eat low-fat foods (Glanz et al., 1993).

In addition to participant behavior, the impact of perceived health control and the impact of health locus of control on dietary adherence have been examined. Arbitrage and Conner (1999) did not find a connection between intentions to adhere to a low-fat diet and either perceived health control or health locus of control. Similarly, no significant differences in actual fat intake at one year from baseline occurred for individuals with an internal or an external health locus of control (Shapiro, Lyman, Kumar, & Bailer, 1991). After the dietary interventions, 38% of participants moved from an external to internal locus of control, but differential changes in dietary intake did not follow (Shapiro et al., 1991). In other words, health locus of control appears to be modifiable, but health locus of control does not appear to increase dietary adherence. Further research is necessary to examine this relationship.

Beliefs about health also may influence adherence to a low-fat diet. The Health Belief Model of behavior change assumes that change is determined by: a belief in personal susceptibility to illness, the impression of disease severity, the degree to which risk is believed to be modifiable by behavioral change, and the degree to which barriers are perceived to be

surpassable (Rosenstock, 1974). The application of the Health Belief Model has rarely been applied to dietary change behavior, but studies that have been done support the idea that dietary behavior is influenced by the factors in the Health Belief Model (Caggiula & Watson, 1992; Contento & Murphy, 1990). In the Caggiula and Watson (1992) study, 117 grocery shoppers were interviewed to determine if they had made dietary changes that were consistent with United States dietary guidelines. Based on the information provided in the interview, individuals were placed into the "self-change" group if they were following nutritional guidelines or into the "no change" group if they did not follow nutritional guidelines. Factors that distinguished between these groups were then examined. The factors that were associated with the self-change group were feelings of personal susceptibility to diet-related disease, perceived benefits from making healthy changes, and general concerns about health (Caggiula & Watson, 1992). In a different study, designed to measure compliance to a cholesterol-lowering diet, one of the characteristics that was most strongly associated with compliance was the perceived costs and benefits of the program (Contento & Murphy, 1990). Although health beliefs in both studies were associated with healthy dietary behavior, the causal direction of these relationships could not be determined because the factors were only associated with one another (Brownell & Cohen, 1995b). Research could more closely examine which aspects of the Health Belief Model are the most important to increase dietary adherence using experimental designs.

Factors to Improve Adherence to Low-fat Diets: A Summary

Because of inconsistencies in methods of measuring fat intake and adherence, and vast differences in treatment programs, it is difficult to draw many strong conclusions with regard to improving adherence to low-fat diets. Several program characteristics have been associated with improved adherence to low-fat diets. Perceived social support has been associated with long-

term adherence to a low-fat diet. In addition, the benefits of self-monitoring and providing dietary feedback are clear, but there are differing opinions on the most efficacious strategy for self-monitoring and providing dietary feedback. Programs that included close behavioral analysis and non-judgmental feedback seemed to be efficacious.

In addition, some participant characteristics might enhance dietary adherence. For example, when compared to individuals with high baseline fat intake (> 60 grams), individuals with lower fat intake (< 60 grams) had better adherence to low-fat diets. As with many other situations, previous behavior predicted future behavior in the case of dietary change. That is, adherence to low-fat diets during a dietary intervention, as measured by self-reported food intake and session attendance, was associated with long-term dietary adherence. In addition, several health beliefs including: beliefs about personal susceptibility to diet related illness, perceived costs and benefits of being on a low-fat diet, and general health concerns have been associated with greater dietary adherence.

In summary, a number of factors have not been adequately examined or have yielded conflicting results and require further examination include: palatability, nutrition knowledge, length and intensity of dietary intervention, level of patient involvement in program development, motivational techniques, and relapse prevention. The current study focused on one of these factors - palatability.

Most weight reduction programs promote increasing dietary fiber and decreasing the overall percentage of dietary fat to approximately 25% of total caloric intake. It is possible that a reduction in dietary fat is associated with changes in fat preference. As dietary fat decreases, so may preferences for fat. Alternatively, it is possible that fat preference remains unchanged even with changes in the consumption of dietary fat. The latter situation might contribute to

adherence problems, a well-documented phenomenon in dietary literature. If it is the case that fat preferences remain unchanged, then the use of low-fat substitutes to maintain the diet's "fat-like" characteristics, while decreasing actual fat intake, may enhance dietary adherence. Research should investigate the relationship between dietary modification, fat perception, fat preference, and the use of fat substitutes.

Taste Preferences: Differences between Overweight and Normal-weight Women

Little is known about possible differences in taste perception and taste preferences between overweight and normal-weight individuals (Jeffery et al., 2000; Kumanyika et al., 2000). Many of the taste-related mechanisms generally thought to underlie eating behavior have been studied separately in normal-weight or obese populations. Surprisingly, little attention has been given to the role of fat perception and fat preference in the development and maintenance of obesity. Research to date has largely been limited to the impact of sweet tastes on preference for foods and consumption of foods. There is, however, an extensive literature examining potential psychological characteristics that may differentiate obese and normal-weights. It is important to understand the major psychological constructs that have been examined in an attempt to understand obesity because fat preference is a psychophysiological phenomenon.

Schachter's Theory of Externality

One of the first comprehensive and testable explanations proposed to differentiate the eating behavior of obese and normal-weight individuals was Schachter's (1971) Externality Theory. According to Externality Theory, obese individuals were thought to be more sensitive and reactive to external stimuli and to be relatively insensitive to internal cues, such as hunger. That is, normal-weight individuals were hypothesized to eat in response to hunger (an internal cue), whereas obese individuals were more likely to eat after seeing or smelling foods (external

cues), even if they were not hungry. Overweight and normal-weight individuals respond differently to external and internal cues. For example, overweight individuals eat more when they perceive it to be dinnertime (Schachter, 1971), when the food is highly palatable (Schachter & Rodin, 1974), and when given a solid preload prior to a meal (Schachter, 1971). In contrast, Schachter and Rodin (1974) found that overweight individuals ate less than normal-weight individuals in the absence of salient sensory cues or when the food tasted bad. In fact, overweight individuals only "out-ate" their normal-weight counterparts when they liked the foods that were offered. Given the palatability of high fat foods, overweight individuals may be at particular risk for overeating high fat foods. The palatability of foods could be one external factor that differentiates overweight from normal-weight individuals.

Externality theory has been sharply criticized (e.g., Drewnowski & Greenwood, 1983). Perhaps the most serious problem has been the nature of the samples used in Schachter's studies. The majority of the research on Externality was conducted on college males, most of who would not be considered obese by more recent standards. Consequently, Externality Theory has been criticized for having limited generalizability. Another problem with Externality Theory was the fact that internal and external cues were presented to be mutually exclusive factors, which is an over-simplification of how these factors influence eating behavior (Drewnowski & Greenwood, 1983). Findings from other studies indicated contradictory results with regard to externality of obese subjects (Rodin, 1981). Rodin (1981) reported that externality occurred in individuals of all weight classes and that external cues can evoke overeating if the right environment was created. Similarly, sensitivity to internal cues has been found in some obese subjects, leading Rodin (1981) to conclude that the rigid separation of internal and external cues was a premature decision, as research indicates that some external stimuli exert their influence through their

impact on internal cues. As a result, research endeavors using Externality Theory to distinguish between normal-weight and obese subjects were largely abandoned (Drewnowski, 1996).

Despite these criticisms, the research on obesity conducted by Schachter and his colleagues was important to understand eating behavior because they sought to examine differences between obese and normal-weight individuals and their work was theory driven. In fact, Externality Theory has not been fully tested and still holds some intuitive appeal with regard to potential etiological mechanisms for obesity. For example, the fact that overweight individuals only ate more than their normal-weight counterparts when foods were palatable suggests that taste of foods may be more important for overweight individuals than for normal-weight individuals.

Dietary Restraint

The examination of psychological factors that impact eating behavior changed course after the simple external/internal dichotomy between obese and normal-weight participants was challenged. Following from Schachter's work, Herman and Mack (1975) developed the construct of "dietary restraint," a cognitive factor describing the substitution of cognitive rules governing eating for physiological regulation, and used it to examine individual differences in eating behavior. Initially, dietary restraint was proposed as a means to differentiate dieters from non-dieters, but the definition of a restrained eater changed over time (Drewnowski, Brunzell, Sande, Iverius, & Greenwood, 1985; Ruderman, 1986). Individuals who are restrained eaters are thought to be highly restrictive with regard to what they eat most of the time, but overeat when "disinhibited" (Ruderman, Belzer, & Halperin, 1985). Several factors have been shown to cause disinhibition in restrained eaters, including the induction of a negative mood state (Cools, Schotte, & McNally, 1992), psychological stress (Ruderman, 1985), and physical threats, such as

an anticipated electric shock (Heatherton, Herman, & Polivy, 1991). Therefore, the construct of dietary restraint goes beyond weight status to explain how cognitive factors related to eating, influence eating behavior.

The impact of taste parameters on the eating behavior of restrained and unrestrained eaters has been examined in some studies. Dietary restraint, but not weight status, predicted hyper-responsiveness, indexed by rate of salivary flow, to olfactory food cues (LeGoff & Spigelman, 1987). Similarly, when presented with pizza as a stimulus, restrained eaters, relative to unrestrained eaters, exhibited twice the rate of salivary flow (Tepper, 1992). With regard to specific tastes, Esses and Herman (1984) reported that after a 12-hour fast, female restrained eaters rated highly concentrated sugar solutions as significantly less pleasant than did unrestrained eaters. After a glucose load, negative alliesthesia to the palatability of sucrose solutions was evident in both restrained and unrestrained eaters (Esses & Herman, 1984). That is, independent of restraint status, the palatability of sugar solutions decreased after the ingestion of a glucose load. In another study without a fasting period, there were no differences in perception of sweetness intensity or preferences between restrained and unrestrained eaters (Frijters, 1984). The differing results could reflect the fact that a forced 12-hour fast may have eliminated the difference in hunger status that may normally exist between restrained and unrestrained eaters. When restrained and unrestrained women were asked to rate the pleasantness, sweetness, and fatness of dairy products with differing levels of sugar and fat, differences between the groups were found (Frye, Crystal, Ward, & Kanarek, 1994). Highly restrained eaters preferred less sweet taste stimuli relative to unrestrained eaters (Frye et al., 1994). However, ratings of perceived sweetness or fatness did not differ as a function of restraint status (Frye et al., 1994).

The construct of dietary restraint has been used to identify some interesting differences in the eating behavior of individuals. While this extension of Schachter's Externality Theory fails to explain differences in eating behaviors between normal and overweight individuals *per se,* it does address key differences in eating behavior among chronic dieters and non-dieters, some of who may be obese.

Taste Perception: Differences Between Obese and Normal-weight Women

One "external" factor that might differentiate normal-weight and overweight individuals is taste perception. As noted earlier, there is surprisingly little research on differences in taste perception between obese and normal-weight individuals. Within either normal or overweight samples, several aspects of taste have been studied, including taste perception, taste preference, and habituation to particular tastes. Significant contributions of individuals working outside of the food industry are briefly described below.

Some of the earliest food consumption research focused on hedonic processes and the development of sweet preferences (Young, 1948a; Young, 1957; Young, 1977; Young & Shuford, 1954). The bulk of Young's work on appetitive behaviors was conducted in rats and allowed him to begin to define and operationalize critical terms including appetite, preference, palatability, and hedonic responses. Following from the work of Young, Cabanac began to search for metabolic differences between obese and normal-weight individuals (Cabanac & Duclaux, 1970). He believed in the existence of a ponderstat or "weight set point" and examined ways that food palatability interacted with this biological feature. Cabanac studied metabolic mechanisms relevant to food intake and satiety (Cabanac & Duclaux, 1970; Cabanac & Rabe, 1976).

Beyond the mechanistic work of Young and of Cabanac, other individuals have focused

on the effects of sensory and environmental factors on food intake and satiety. One example is Rolls' work on food palatability and the availability of a variety of tastes on food intake (Rolls, 1990; Rolls, Fedoroff, Guthrie, & Laster, 1990; Rolls, Hetherington, & Burley, 1988; Rolls, Laster, & Summerfelt, 1991; Rolls, Van Duijvenvoorde, & Rolls, 1984). Rolls brought taste-related research out of the laboratory and into the real world and much of her work has immediate clinical utility and applicability. An example of this utility is her work on how the availability of a variety of tastes increased food consumption in the elderly (Rolls, 1999).

Over the past 25-years, de Castro has examined the impact of physiological, psychological, and sociological factors on eating behavior (de Castro, 1988; de Castro, 1996; de Castro & Brewer, 1992; de Castro, Brewer, Elmore, & Orozco, 1990; de Castro & Kreitzman, 1985). Based on 7-day food diary information, he investigated the impact of factors that include, but are not limited to, hunger (de Castro, 1988), time of day (de Castro et al., 1990), day of the week (de Castro, 1991), location (de Castro et al., 1990), number of people present (de Castro, 1992 & Brewer, 1992), and relationship to eating companions (de Castro, 1994) on food intake. These studies indicated that individuals were likely to eat more when with someone than they were likely to eat when alone. These effects were evident in a variety of locations, including home and restaurants, and for meals eaten at all times of the day (de Castro et al., 1990), and on all days of the week (de Castro, 1991). When individuals ate with large groups, their meal size was 75% larger than when they ate alone (de Castro & Brewer, 1992). In addition, when individuals ate meals with their spouses or families they ate more than with other companions (de Castro, 1994). The researchers attributed this effect to greater disinhibition from dietary restraint when individuals were relaxed because they were in the company of their spouse or family (de Castro, 1994).

Drewnowski and colleagues have examined the role of sweet and fat perception, and preferences on food intake over the past two decades (e.g., Drewnowski, 1989; Drewnowski, 1990; Drewnowski, 1993; Drewnowski et al., 1985; Drewnowski & Greenwood, 1983; Drewnowski, Krahn, Demitrack, Nairn, & et al., 1992a; Drewnowski, Kurth, Holden-Wiltse, & Saari, 1992b; Drewnowski & Schwartz, 1990; Drewnowski, Shrager, Lipsky, Stellar, & et al., 1989). The work of Drewnowski and colleagues began to unravel the confusion surrounding earlier taste research by examining more complex relationships including fat and sugar combinations (Drewnowski et al., 1985; Drewnowski & Greenwood, 1983). He also began looking at more detailed individual differences among obese subjects, in order to identify subgroups of obese subjects and to determine the effects of age of onset of obesity and a history of weight fluctuation on subsequent food selection (Drewnowski, 1991; Drewnowski, 1993; Drewnowski, Cohen, Faust, & Grinker, 1984).

Overview of Taste Parameters and Applicability to Obesity

The subsequent paragraphs briefly review research on taste and taste-related factors relevant to the current investigation on taste preferences among overweight women undergoing weight loss treatment. The taste parameters addressed include taste preference, palatability, and hedonic qualities of foods.

Taste preference is an evaluative difference between two or more items that extends beyond a simple perceptual difference, to suggest greater palatability of one taste over another (Young, 1977). In human and other animal studies of food preference, two or more foods are made continuously available, positions of the food choices are rotated, and food intake is measured. Preference is inferred from the consistent choice of one food over another. Young (1977) described two types of preference, one based on palatability and one based on biological

need. He believed that biological needs influence, but do not dictate, palatability. For example, an animal with a particular vitamin deficit may find foods with high levels of that vitamin to be more palatable than it might in the absence of that vitamin deficit, but would not necessarily seek out foods with high levels of the vitamin.

Palatability refers to the perceived tastiness or likeability of a particular food and is dependent on one's hedonic response to the food (Young, 1977). Berridge (1996) described palatability as an affective component of food reward that can be thought of as a psychological process that incorporates factors such as taste, an individual's physiological state, and learning history. In animals, palatability and hedonic responses are inferred from specific eating behaviors such as paw licking (pleasant, likeable) or food avoidance (unpleasant, not likeable). In humans, these responses are typically assessed by subjective ratings.

Hedonic response to foods refers to the amount of pleasure derived from food or the degree to which a food is liked (Young, 1977). Hedonic responses occur on a continuum ranging from pleasant and appetitive to unpleasant and aversive. Hedonic ratings are often inferred from palatability ratings. That is, when a food is rated as likeable, it may be inferred that it has more positive hedonic qualities (e.g., sweeter, creamier). It was Young's (1966) thesis that behavior is motivated and organized, in part, by the hedonic effects of sensory stimulation. The development of preferential behavior is thought to be dependent on the hedonic effects of sensory stimulation (Young, 1966).

The research reviewed utilizes both laboratory taste test and free-eating paradigms with both human and rat samples. The human study samples vary from normal-weight college men to obese women. Many of the taste parameters have been studied only in a particular population, and it is the exception that a taste parameter has been compared between different populations.

For the most part, interesting findings with regard to taste have emerged separately among normal-weight participants and among overweight individuals, and much more work remains to be done to examine potential differences between the groups.

Taste Preference

There is an extensive animal literature examining food preferences that begins with the early work of Richter (1943) and Young (1948a; 1948b). This work is reviewed extensively elsewhere (Booth, 1982; Rozin, 1976; Rozin & Schulkin, 1990) and includes findings such as the fact that rats can develop robust and reliable food preferences (Sclafani & Nissenbaum, 1988). In addition, heightened responsiveness to a high fat diet has been detected in genetically obese Zucker rats (Sclafani, 1985).

Human literature on food choice is modest-sized and preliminary according to Rozin (1996). One potential mechanism that underlies expression of obesity in humans and animals could be an enhanced hedonic response to high fat foods among obese individuals (Drewnowski, 1996). While it is beyond the scope of the current proposal to review the creation of food preferences in children, it is important to note the existence of innate and learned aspects of food preferences (Birch, 1987). Preferences for sweet tastes are known to exist in newborns across many species. The process of acquiring additional food preferences appears to occur in stages and includes the pairing of post-ingestive consequences with certain tastes. For example, a preference for fat appears to be, at least in part, an acquired taste that develops after an individual begins to associate eating fat with feeling full. Immediate and delayed consequences are associated with the smell and taste of foods consumed by young children (Hetherington & Rolls, 1996).

Much of the taste research examining differences between obese and normal-weights has been limited to the role of sweet tastes on preference for and consumption of foods. Drewnowski and colleagues (1985) have reviewed this literature. Sensitivity to sweet flavors makes the recognition of high-energy carbohydrates possible and may be biologically adaptive (Young, 1977). Now that Americans have developed increasingly sedentary lifestyles and have lower energy needs, this former advantage has become a disadvantage.

Normal-weight and overweight individuals respond differently to sweet tastes. For example, a glucose preload following a 12-hour fast resulted in a decreased liking for sucrose solutions among normal-weight individuals, while likeability of the sucrose solution among obese individuals remained unchanged (Cabanac & Duclaux, 1970). Normal-weight individuals lost their "appetite" for sweet solutions after exposure, whereas obese individuals did not (Cabanac & Fantino, 1977). These findings suggest that overeating, obesity, and heightened sweet taste responsiveness may be associated.

Grinker (1978) attempted to tease apart whether the differences between the weight groups on hedonic ratings of sweet solutions were a result of a difference in perception of sweetness or difference in preference for sweetness. Overweight individuals rated the sweeter option less pleasant than the normal-weight individuals and they consumed less of the sweeter beverage (Grinker, 1978). These results are consistent with Schachter and Rodin's (1974) finding that overweight individuals eat more of a preferred food, but less of food that they find unpleasant than do normal-weight individuals.

The principle cause of obesity was once thought to be the presence of a "sweet tooth" or hyper-responsivity to sweet foods (Drewnowski et al., 1985). Excess carbohydrate intake was blamed for excess weight gain. Some researchers went so far as to look for a chemical basis for

the differential responsiveness to sweets proposed to exist between obese and normal-weight individuals (Wurtman, 1984). For example, Wurtman (1984) proposed the serotonin-hypothesis of obesity, suggesting that obese individuals suffered from an underlying serotonin deficit. "Self-medication" with carbohydrates was hypothesized to provide tryptophan, the precursor for serotonin. Therefore, obesity was thought to be a consequence of altered food intake (increased caloric intake from carbohydrates) used to bolster serotonin levels (Wurtman, 1984). Studies of the eating behaviors of obese and normal-weight women indicated similar overall dietary composition (carbohydrate, protein, and fat), but greater caloric intake among obese women (Schlundt et al., 1993). Also, treatment with selective serotonin reuptake inhibitors (SSRIs) and other antidepressants has not significantly impacted the weight status of non-depressed obese individuals (Mayer & Walsh, 1998). These findings suggest that excessive carbohydrate intake alone is not the sole cause of obesity in most individuals.

Fat Preference

After the carbohydrate theory of obesity lost its appeal, Drewnowski and colleagues (1992b) proposed that a preference for high fat, not sweet tastes (carbohydrates), might be a fundamental feature of obesity. Unfortunately, relative to sweet tastes, much less work has been done examining the role of fat on preference for foods and consumption of foods (Rozin, 1996). In the work that has been done, differential responses to high fat food items have been reported in overweight and normal individuals. For example, obese individuals, but not individuals meeting criteria for anorexia nervosa, sought out fat-rich foods when given the opportunity (Drewnowski, 1991). In addition to the nature of the food stimulus, fat preferences were influenced by subject characteristics (Drewnowski, 1993). For example, hedonic responsiveness was associated with current body weight, dieting history, and the presence of bulimia nervosa or

anorexia nervosa in female participants (Drewnowski, 1993). Drewnowski (1993) found that preferences for sweet tastes, relative to fat content, varied inversely with body fatness in a study examining preferences for varying levels of sugar and fat in dairy products among women. Obese women preferred foods that were rich in fat and low in sugar while anorectic women preferred sweet, nonfat foods. Among the obese women, preferences for high fat, low sugar foods were even more pronounced among obese women who had a history of weight fluctuations (Drewnowski et al., 1992b).

Fat preferences in rats have been linked to early feeding history and are resistant to change, even after a forced shift to a low-fat diet (Warwick, Schiffman, & Anderson, 1990). These findings have important implications for human obesity treatment where adherence to low-fat diets is a major concern. It may be useful to examine the relationship between early feeding history and fat preferences in humans. If fat preferences in humans were also resistant to change, then the use of fat substitutes among obese individuals attempting to lose weight would be warranted. In fact, individual profiles of fat sensitivity and fat preference may provide a useful experimental marker of an individual's responsiveness and adherence to a low-fat diet

Palatability and Consumption

Sensory characteristics including palatability, flavor, and taste largely influence food selection and total caloric intake in humans (Carmody, Matarazzo, & Istvan, 1987). Not surprisingly, food consumption increases with increased palatability (Geiselman, 1988; Geiselman & Novin, 1982; Spitzer & Rodin, 1981). Rozin and Schulkin (1990) reviewed the role of social influence on the development of liking for innately unpalatable food and concluded that the meaning of food (as a source of pleasure and/or a source of nutrition) is culturally determined and that beliefs surrounding foods affect human consumption.

Palatability is the variable that has most consistently differentiated the amount eaten between normal-weight and overweight individuals (Spitzer & Rodin, 1981). Increased consumption in response to highly palatable foods is even more pronounced among obese individuals when they are compared to normal-weight individuals (Spitzer & Rodin, 1981). Given that palatability depends on the nature of the foods eaten (i.e., an external factor), these findings are consistent with Schachter's Externality theory, which predicted that overweight individuals are more responsive to external cues than are normal-weight individuals (Schachter, 1971).

Lucas and Sclafani (1990) proposed enhanced responsiveness to palatable foods as a cause of dietary-induced obesity in humans and animals. A reduced ability to associate food flavor with fat calories might be one potential mechanism for overeating and weight gain (Warwick, Bowen, & Synowski, 1997). That is, individuals with a greater ability to detect the presence of fat in foods might alter their food intake to eat less when eating high fat foods. Individuals who are not able to detect the presence of fat would be unable to moderate their food intake based on fat content and might be more likely to exceed desired kilocaloric levels.

Foods containing both fat and sugar are highly palatable. Dietary consumption in rats increased 50-100% when rats were exposed to a "supermarket" diet where a number of high-sugar/high-fat foods are available (Sclafani, 1989). Humans consuming high-sugar/high-fat foods required twice as many kilocalories to achieve satiation than humans consuming either savory/high-fat or savory/low-fat foods (Green, Delargy, Joanes, & Blundell, 1997).

Hedonics and Consumption

An important question regarding the reinforcement value of food surrounds the eating behavior of normal-weight and obese individuals. It is possible that obese individuals obtain

more pleasure from food and eating than do normal-weight individuals. Pleasure is not a quality of food, but instead it is something that is derived from food and the experience of eating (Hetherington & Rolls, 1996). Pleasure is central to eating and affects the development of food preferences, guides the selection of specific foods, aids in the association between flavors and postingestive consequences, and influences when eating is terminated (Hetherington, 1993). Individuals with eating disorders or obesity may have a skewed experience of pleasure from eating. That is, negative beliefs surrounding self or food may inhibit the individual's ability to enjoy typical meal consumption. The expectation of receiving pleasure from food may then lead to over-consumption in situations when pleasure is not obtained from eating.

The choice of foods is influenced by both immediate and delayed hedonic effects of the food, making understanding the impact of pleasure on eating behavior important (Young, 1977). That is, food consumption is initially determined by an individual's immediate response to a particular food, and further influenced by the individual's perceived reactions to its consumption in the long run. Berridge (1996) delineates two components of pleasure derived from eating: liking and wanting. "Liking" of foods has been examined in studies that measured pleasure responses in animals (e.g., licking paws) and subjective ratings among humans (Berridge, 1996). In contrast, "wanting" has been assessed in animals by a willingness to work for a food (incentive) and the reported desire to eat (appetite) in humans. Although hedonics are known to be influenced by need state (a component of "wanting"), the concept of "liking" plays a critical role in hedonic ratings and hedonic responses to foods originate after any sensory contact with the food (Hetherington & Rolls, 1996).

The examination of hedonic ratings of sweet tastes among normal and obese individuals has yielded conflicting results. Moderately obese individuals displayed a relatively greater

"liking" of sweet tastes in some studies (Cabanac & Duclaux, 1970; Rodin, Moskowitz, & Bray, 1976; Wooley, Wooley, & Dunham, 1972), but not others (Grinker, 1978; Grinker, Hirsch, & Smith, 1972; Grinker, Price, & Greenwood, 1976; Malcolm, O'Neil, Hirsch, Currey, & Moskowitz, 1980; Underwood, Belton, & Hulme, 1973). Drewnowski and colleagues (1985) cite methodological discrepancies to explain these inconsistent findings. Specifically, studies using sugar solutions instead of everyday foods containing sugar (and frequently fat as well) found greater hedonic response to sweet tastes among overweight individuals, relative to normal-weights (Drewnowski et al., 1985). This difference suggests that studies should include everyday foods.

Looy and Weingarten (1991) found that the impact of food deprivation on reactivity to sweet tastes was mediated by the individual's hedonic response to sweet flavors. Metabolic state did not predict changes in either reported sweet intensity or hedonics in individuals whose hedonic response to sweet flavors increased as the sugar content increased (Looy & Weingarten, 1991). Conversely, individuals reported an accentuated dislike for sweet tastes when deprived, if they were individuals who also reported decreased hedonic ratings when sugar concentration was increased. Therefore, both hedonic ratings and metabolic state are important factors to consider when examining taste preferences and consumption.

In our laboratory, we examined differences in taste mechanisms using a series of studies that compared overweight and normal-weight women on three key dimensions of taste-related factors: fat preference, functional aspects of eating, and sensory specific satiety (SSS) (Kalupa, Sbrocco, Lewis, Stone & Nedegaard, 2000; Kalupa et al., under review). Our findings indicated that, contrary to hypotheses, obese and normal-weight women preferred fat equally and reported similar dietary fat intake, which was just slightly less than the national average and higher than

current recommendations. That is, everyone, regardless of weight status, liked fat, as indexed by more positive hedonic ratings on sweetness, creaminess, flavor, and the likeability of a high fat pudding relative to a low-fat pudding. However, higher baseline fat intake was associated with a more dramatic preference for high fat pudding. It would be difficult to conceptualize that the relationship between dietary fat intake and taste preferences occurred as a result of weight status, because baseline fat intake and BMI were not related. It is not clear if dietary intake is dictated by a high fat taste preference or if dietary intake maintains a learned preference for high fat foods, or if both are true.

Although fat preferences did vary with baseline fat intake levels, there did not appear to be substantial differences in taste perception between individuals with higher baseline fat intake and those with lower baseline fat intake, as their hedonic ratings of sweetness, creaminess, or flavor did not differ from one another. Only differences in the likeability and desire for more high fat pudding were found among individuals with different baseline fat intakes. It is not known if fat preference is a malleable phenomenon. This fact points to the need to understand the impact of dietary fat modification on dietary adherence as the typically prescribed fat reduction affects diet palatability.

Impact of Dietary Fat Modification and Sensory Exposure on Hedonic Experience

Hedonic responses to food may be important to understand adherence to low-fat diets. When compared to bland-tasting foods, nutritionally equivalent foods that were flavorful were more satiating (Rolls, 1990; Warwick, 1993). Many flavor molecules are fat-soluble and, therefore, the reduction of dietary fat may affect the flavor of a diet. It is possible that weight reduction programs that encourage a reduction in dietary fat do not provide enough flavor for the

diet to be satiating. This lack of satiety may contribute to difficulties in adherence to a weight-reduction diet and, ultimately, to barriers to successful weight loss.

As noted earlier, only two studies to date have systematically examined the sensory impact of dietary fat modification and its effects on dietary adherence (Guinard et al., 1999; Mattes, 1993). Mattes (1993) examined food acceptability and fat perception during adherence to a reduced-fat diet among healthy, normal-weight individuals. Significant dietary fat reduction was achieved in the experimental groups, but hedonic ratings for high fat foods only declined in the group without sensory exposure to fats or fat-like substances. That is, a hedonic shift in the experience of fat was found in response to adherence to a low-fat diet, but only when fat-modified substances were not used. These findings indicated that the frequency of exposure to fats, not simply total fat intake, influenced hedonic ratings of foods containing fat. It is possible that a hedonic shift, if achieved, could help to enhance adherence to a low-fat diet. If this is the case, then the use of fat-modified foods may actually prevent this hedonic shift and negatively affect long-term compliance. In other words, the Mattes (1993) study indicated that people might be able to "learn" to enjoy a low-fat diet if they adhered long enough for a hedonic shift to occur.

Guinard et al. (1999) conducted a longitudinal study that examined the relationship between fat intake and taste responses to fat as part of the larger "Dietary effects on lipoproteins and thrombogenic activitiy-1" (DELTA) study (Dennis et al., 1998). Participants in this study consumed three highly controlled 8-week diets that varied in fat content. Contrary to the Mattes (1993) study, findings from this study suggested that varying total fat intake did not impact sensory response to fat in taste tests. Fat intake was set at 37%, 30%, or 26% and may not have provided a sufficient reduction in dietary fat to affect sensory experience of fat. The results from

this study indicated that sensory factors might not be unduly influenced by modification of dietary fat intake. That is, hedonic shifts might not occur in response to dietary modification. In this case, using fat-modified substances to enhance flavor might improve adherence to a low-fat diet because preference for fat remained despite dietary modification. However, it might be that this experiment lacked adequate statistical power to detect differences between the groups.

CURRENT INVESTIGATION

Preliminary research has revealed similar levels of dietary fat consumption and preferences for fat among overweight and normal-weight women (Kalupa, Sbrocco, Lewis, Stone, & Nedegaard, 2000; Kalupa et al., under review). That is, all participants preferred high to low-fat food samples. These findings on fat preference highlight the need to understand the impact of dietary modification, particularly lower fat diets, on taste perception, and preferences. The current investigation was developed in response to clinical observations of a change in fat preference over the course of weight loss treatment. After placement on a low-fat diet, women initially complained about a flavor deficit and general reduction in palatability of their foods. However, after several weeks many of these same women reported disliking the taste of fat to the point of feeling nauseous when they returned to eating high fat foods (e.g., after eating a high fat fast food meal).

The current study extended the taste research that was done in our laboratory and explored the impact of dietary change on fat preference. This study continued programmatic work examining the effect of dietary fat modification and fat substitutes on dietary adherence. There were two major aims of the current investigation. The first aim was to examine changes in fat preference and the sensory experience of fat across three groups differing in fat intake and in fat exposure. The effects of sensory exposure to fat and to fat substitutes were examined across

each group and over time. The second aim was to explore the relationship between fat preference and short-term dietary adherence. Dietary adherence to an 1800-kilocalorie diet was examined across the three groups post treatment. Three dietary interventions that were designed to operationalize the key constructs are summarized below and then the hypotheses corresponding to each aim are detailed.

The current study differed from the Mattes (1993) and the DELTA (Guinard et al., 1998) studies in several ways and extended this work by addressing some of the conceptual and methodological problems identified. First, a larger sample (N = 61) was used to insure that the study had adequate power to detect a medium effect size. It was possible that with a total of only 20 participants, the DELTA study lacked adequate power to detect important group differences.

Additionally, the proposed study was done with otherwise healthy, overweight women. Because overweight women are at greater risk for several diseases, they might have been more motivated to change than healthy normal-weight women. Individuals with greater perceived risk of dietary-related disease were more likely to adhere to a low-fat diet (Caggiula & Watson, 1992). In addition, all the participants were overweight, unlike the Mattes (1993) study, where only one of the three groups was overweight. Evidence that suggests that overweight and normal individuals experience fat in foods differently was reviewed earlier in this proposal.

Beyond the weight status of participants, gender was a factor that was treated differently in the current investigation. In the DELTA (Guinard et al., 1998) and Mattes (1993) studies, both men and women were used. The experience of taste differs across genders (e.g., Grunberg, & Straub, 1992; Kunz, 1993; Laeng, Berridge, & Butter, 1993). Using a sample that was all female provided more information about the impact of dietary change on fat preference in women. For the current investigation, women were chosen as the focus of study because women

are disproportionately affected by problems of obesity (NIH, 1998). In addition, eating behaviors, attitudes towards food, dieting, and taste perception differ between men and women (Wood, 2000; Rolls, Fedoroff, & Guthrie, 1991; Roos, Lahelma, Virtanen, Praettaelae, & Pietinen, 1998). For example, women are more likely to experience problems with emotional eating (Wood, 2000), to experience food-related conflict (Rolls, Federoff, & Guthrie, 1991), to have a history of previous dieting behavior (French, Jeffery, & Wing, 1994), and to report more motivational barriers to weight control than men (French, Jeffery & Wing, 1994). These differences indicate that obesity may develop for different reasons among men and women making a mixed gender group difficult to run and less effective for participants.

The current interventions were more intensive than previous interventions, as they met on a weekly basis and addressed a set series of topics. Neither the Mattes (1993) nor the DELTA (Guinard et al., 1998) study met on a weekly basis for behavior therapy or nutrition education. In the Mattes (1993) study, participants were simply given recipes to follow and a phone number to call if they had questions and were asked on a monthly basis to record their food intake. In the DELTA study, participants were simply asked to eat at a feeding center for a prescribed period of time and were not given information about the phase of dietary intervention. The current study was conducted in a group format, which might provide greater social support and more of an opportunity for people to problem solve around obstacles to dietary change. Dietary feedback was provided on a weekly basis, based on daily food diary information, which should have helped to enhance dietary adherence (Buzzard et al., 1996).

Another difference between previous studies and the current intervention was the total kilocaloric intake that was prescribed. The Mattes (1993) study resulted in differential changes in caloric intake across conditions. That is, individuals in the low-fat conditions of his study

consumed fewer kilocalories than the individuals in the high fat condition. The current study set kilocaloric intake at 1800-kilocalories for all of the conditions. The current design might help to tease apart whether the sensory changes seen in the Mattes (1993) were a result in changes in fat intake or as a result of total kilocaloric restriction. Although this approach might elucidate the relationship between dietary fat restriction and the sensory experience of fat, adherence to the intervention diets might be negatively affected if a restriction in total kilocaloric intake exacerbates feelings of deprivation. A desire to lessen the feelings of deprivation associated with total kilocaloric restriction led to the choice of a mild kilocaloric restriction of 1800.

Description of Treatment Groups

1. HIGH TASTE. Participants in this group were instructed to eat an 1800-kilocalorie diet while maintaining 36% of their total kilocalories in fat. Fat influences the flavor of diets. Therefore, if the fat content is maintained at 36%, similar to the typical American diet, an 1800-kilocalorie diet may be easier to follow. Learning to eat less of the "typical American diet" m might prove to be an effective strategy in promoting dietary adherence. Enhanced adherence might help individuals lose more weight.

2. LOW FAT. Participants in this group were instructed to eat an 1800-kilocalorie diet and to reduce their dietary fat to 20-25% of their total kilocalories. In this group, individuals were instructed not to use fat substitutes. If individuals were able to consume a low-fat diet for a number of weeks, then they might begin to dislike high fat foods. That is, it might be possible to "learn" to like a low-fat diet if given enough time to adjust. Individuals who developed a distaste for fat might be less likely to return to a high fat diet.

3. FAT SUBSTITUTE. Participants in this group were instructed to eat an 1800-kilocalorie diet, and to reduce fat to 20-25% of their total caloric intake. Unlike the LOWFAT group, individuals

in the FAT SUBSTITUTE group were told to use certain discretionary fat substitutes. It might be easier to adhere to a low fat diet if individuals are able to enhance the flavor of their diet by adding fat-like substances to their foods. That is, adhering to mild kilocalorie restriction program might be easier if the taste of foods was improved by adding fat substitutes.

Specific Aims

There were two basic aims of the current study. The first was to examine the impact of dietary fat on fat preference and the sensory experience of fat. This aim was accomplished by manipulating dietary fat intake and examining fat preferences and the sensory experience of fat. The second aim was to evaluate the impact of sensory changes on short-term dietary adherence. This aim was accomplished by examining adherence to prescribed total kilocalorie level and prescribed fat level, as well as, examining session attendance during the six-week intervention.

Aim One. Impact of dietary fat on fat preference and on the sensory experience of fat

1. It was hypothesized that during a sustained (6 week) low-fat diet (20-25% of total caloric intake), without fat substitutes, preference for fat would decrease. This change would have been evident if hedonic ratings shift in a positive direction for the low-fat food samples and in a negative direction for the high fat food samples.

    a. Decreased fat preferences would be most dramatic for individuals with the highest baseline dietary fat intake. That is, a greater hedonic shift was hypothesized among individuals consuming more fat.
    b. Alternatively, it might be possible that fat preference would remain unchanged even with reductions in the consumption of dietary fat. That is, people might adhere to a low-fat diet, but still prefer high fat foods at the end of treatment. If

this was true, then it was hypothesized that there would be a lack of change in hedonic ratings from pretreatment to post treatment. Specifically, even individuals in the LOW FAT group would be hypothesized to rate high fat foods as more pleasant than low-fat foods after completion of treatment.

c. Fat preferences would not be modified as a result of mild caloric restriction. Individuals assigned to the HIGH TASTE group would continue to consume more than 30% of their total kilocalories in fat. They were not hypothesized to show a change in fat preference at the end of the dietary intervention. Reducing dietary fat was thought to be the critical factor in influencing fat preferences. Therefore, a hedonic shift was not hypothesized in the HIGH TASTE group. In addition, the HIGH TASTE group's preference for high fat foods was hypothesized to remain higher than their preference for low-fat foods.

d. Fat substitutes used within a low-fat diet would maintain preference for dietary fat. It was hypothesized that individuals using fat substitutes would not show a change in fat preference at the end of the dietary modification. Fat substitutes might maintain high fat preferences in the face of dietary change. Maintaining sensory exposure to fat-like characteristics might be a sufficient means to maintain preferences. This would be reflected in the absence of a hedonic shift among individuals consuming fat substitutes. In addition, individuals in the FAT SUBSTITUTE group would have a greater preference for high fat foods than low-fat foods.

Aim Two: Impact of Sensory Changes on Short-term Dietary Adherence

1. Hedonics were hypothesized to impact dietary adherence and weight loss. Specifically, because it was hypothesized that individuals in the LOW FAT group would experience a hedonic shift resulting in a decrease preference for high fat foods, and an increase in preference for low-fat foods, these individuals were predicted to exhibit greater adherence to an 1800-kilocalorie during the dietary intervention. Adherence to dietary invention was measured in a variety of ways including total energy intake, fat intake, and session attendance. It was hypothesized that individuals in the LOW FAT group would eat significantly less kilocalories, have lower fat intake and have better session attendance than the HIGH TASTE and FAT SUBSTITUTE groups.
2. No hedonic shift was hypothesized for individuals in the FAT SUBSTITUTE group. Therefore, if the FAT SUBSTITUTE individuals continued to prefer high fat, they may be at high risk for returning to eating a high fat diet. If, this was true, then individuals in the FAT SUBSTITUTE group would report a higher dietary fat intake at post treatment than the LOW FAT group.
3. Alternatively, if fat preference remained high, despite dietary modification, short-term adherence would not be enhanced in the LOW FAT group. In fact, if people continued to like fat, even if they consumed a low-fat diet, then they might be at risk to return to eating high fat foods. If this was true, then individuals in the LOW FAT group would report a higher fat intake at post treatment than the HIGH TASTE group.

4. If fat preferences remained high, despite low-fat dietary modification, it was hypothesized that the use of fat substitutes would enhance short-term adherence to a low-fat diet. Fat substitutes might improve the palatability of a low-fat diet, through an altered hedonic experience without adding kilocaloric value. That is, if people liked fat, despite dietary modification, individuals who used fat substitutes might be more likely to adhere to a low-fat diet. If, this was true, then individuals in the FAT SUBSTITUTE group would report lower dietary fat than individuals in both the HIGH TASTE and LOW FAT groups.

RESEARCH DESIGN AND METHODS

Participants

Ninety-eight overweight women (BMI 27-37 kg/m^2) between the ages of 18-60 were phone screened, found to be eligible, and invited to attend an orientation session to learn more about the weight loss intervention (see Appendix A for phone script and phone screen). Exclusion criteria included diabetes, uncontrolled hypertension, kidney disease, thyroid disease, current pregnancy or lactation, current use of prescription or over the counter weight loss medication (e.g., Dexatrim, Meridia, Orlistat), prescription drugs known to influence weight (e.g., Antidepressants, Synthroid), current status as a smoker, recent weight loss (> 10 pounds in the past month or > 20 pounds in the past 6 months), or food allergies to milk or pudding products. Additional exclusion criteria included the presence of clinical depression, as defined by a Beck Depression Inventory II (BDI-II) score > 21, or significant eating pathology, defined by a score of greater than 10.5 on the bulimia subscale of the Eating Disorders Inventory (EDI). In addition, participants had to consume more than 30% of their daily kilocalories in fat (based

on Fat Intake Scale score > 24). This amount of dietary fat reflects the "average" American diet, which contains approximately 36% fat.

As part of baseline, participants completed a one-week computerized baseline food diary to qualify for entry into the 6-week weight loss program. Participants were compensated up to $40 for their participation ($10 for completing pretreatment taste tests and questionnaires, $20 for completion of the 6-week intervention, and $10 for completing the post-treatment taste tests and questionnaires). Participants were told that the study's purpose was to examine the impact of taste on adherence to a mild kilocalorie restriction diet.

Measures

Demographic Information. Each participant was asked to report age, gender ethnicity/race, education, employment, and household income. A copy of the demographic information solicited is attached (See Appendix B).

Anthropomorphic Information. Weight in pounds was measured using a Detecto brand balance beam scale (model 3P704) at orientation 1 and orientation 2 during baseline, and at each of the six weekly meetings. Height, to the nearest ½ inch, was measured at the first orientation. Body mass index (BMI) in kg/m^2 was calculated from weight and height measurements.

Medical Information. All potential volunteers were phone screened by the principal investigator or by a research assistant, trained by the principal investigator. Volunteers were screened for hypertension, diabetes, kidney disease, and thyroid disease. In addition, volunteers were asked to identify any prescription medications that they were using at the time of recruitment. Dr. Evelyn Lewis, a physician in the Department of Family Medicine, at the Uniformed Services University of the Health Sciences, reviewed participant medical information to determine medical ineligibility. All participants completed a medical information packet,

including a permission form that the participant's physician was required to sign prior to enrollment in treatment. A copy of the medical information form is attached (See Appendix C). Dr. Lewis was available to answer study-related health questions or concerns during the course of the intervention.

Dietary Intake. Two measures of dietary intake were utilized during the current investigation.

1. **Fat Intake Scale-** The Fat Intake Scale (FIS) is a brief 12-item dietary assessment instrument that was developed to be a quick and economical way to estimate dietary fat intake (Retzlaff, Dowdy, Walden, Bovbjerg, & Knopp, 1997) (see Appendix D). The twelve questions assess intake of several items including high fat meats, egg yolks, commercial baked goods, ice cream, and snack foods. In addition, the scale asks individuals to report the type of fat that they cook with and to report their eating behavior away from home. During the phone screen, the principal investigator or a trained research assistant read each question and each of the possible answers aloud to the participants. Individuals with a 24 or great on the FIS were allowed to participate in the study, as these scores reflect a diet that was >30% fat (Retzlaff et al., 1997). The FIS was scored while the potential volunteer remained on the phone and the volunteer received immediate feedback about their eligibility for the study. The FIS has been shown to have good 2-3 week test-retest reliability for women (r = .90) (Retzlaff et al., 1997). In addition, the FIS has been shown to have good content validity when correlated with 4-day food records (Retzlaff et al., 1997). Fat intake reported in the food records was highly correlated with FIS scores during baseline (r = .54) and during a dietary intervention (r = .58) (Retzlaff et al., 1997).

2. Computerized food diaries- During baseline, participants kept 1-week of computerized self- monitoring food diaries using Psion 3.0 A palmtop computers (Psion PLC, 1994). Participants were asked not to alter their typical eating patterns during this baseline period of self-monitoring. Daily food diaries were selected to measure food intake for several reasons. First, food diaries are considered the "gold standard" measure of food intake against which other approaches, including food frequency checklists and food recalls, are compared. Schaefer and colleagues (2000) found that information from 3-day food diaries agreed with actual food intake (true diet composition was known) better than information from a food frequency questionnaire. There were no statistically significant differences between 3-day food diaries and actual intake of a diet of known composition on kilocalorie intake, percentage of fat, saturated fat, protein intake or carbohydrate intake (Schaefer et al., 2000). In fact the only significant difference between actual food intake and the food diary information was that on the food diaries, individuals significantly underreported their intake of monounsaturated fat (Schaefer et al., 2000). In addition to being the gold standard, food diaries were also selected because they provide rich clinical data including eating patterns that guide treatment planning.

One potential problem associated with self reported food intake information is underreporting of energy intake. The degree of kilocaloric underreporting among overweight individuals is quite variable, although estimates of 500 – 1000 kilocalories each day have been offered (Lowe, Kopyt, & Buchwald, 1996). Based on studies that use doubly-labeled water techniques as the gold standard, underreporting of food intake is a pervasive problem (e.g., Schoeller, 1990). The doubly-labeled water technique is a method used to assess energy expenditure that is based on the calculation of carbon

dioxide production from differential disappearance rates of two stable isotopes of water (Lichtman et al., 1992). One methodological issue that contributes to the problem of underreporting is the use of "serving sizes" in food recording. This methodological issue was minimized in the current investigation because all participants were given a dietary scale and told to record the weight of the foods consumed instead of a recording a less reliable "serving size."

Computer based self-monitoring has been shown to be a more reliable way to monitor food intake than hand written food diaries (Sbrocco, Lewis, Nedegaard, Stone, Gallant, & Patel, under review). Additionally, in a sample of overweight and normal weight women, computer-based food diaries were shown to be no more time consuming than traditional paper-and-pencil food diaries and were rated as twice as useful by participants, compared to the traditional diaries (Vaughn, Kalupa, Sbrocco, & Lewis, 2001).

Dietary intake was recorded using the Comcard Compute-A-Diet Nutrient Balance System (1994) software program that contained almost 4,000 foods from the United States Department of Agriculture database (Software Comcard Ltd., 1994). Participants were asked to weigh all foods in grams or ounces using a Healthometer brand (Boca Raton, Florida) 16-ounce capacity (model 3222) portable scales and were asked to record all food and beverage intake in the Psion. Caloric data from these logs was summarized using the Comcard software program. Mean caloric intake and percentages of kilocalories from fat, carbohydrate, and protein were calculated.

Adherence Variables. Adherence was measured by session attendance, days of completed food diaries, average daily caloric intake, average daily fat intake, and fat substitute use. Participants were required to keep a computerized food diary for the 6 weeks of active treatment. Each week their caloric consumption and dietary composition was determined based on information in their food diaries. Individuals were also required to keep track of the amount of fat substitutes they used each day on paper-and-pencil Fat Substitute forms (see Appendix E). Based on downloaded food diary information, adherence to food diary completion, average weekly kilocalorie intake, average weekly fat intake, and average weekly fat substitute intake was examined for each group. During part of each psychoeducational session, all groups discussed barriers to adherence and time was spent problem solving around these barriers. Individuals who missed a session were contacted by phone to schedule an individual makeup session. Makeup sessions typically lasted one hour and addressed topics covered in the missed session, as well as addressed the important of attending the group sessions.

Self Report Measures. At the first orientation, each participant was asked to complete two questionnaires.

1. **Eating Disorders Inventory**- Participants were asked to complete the Eating Disorders Inventory (ED) to assess for the presence of eating pathology (Garner, Olmstead, & Polivy, 1983). Drewnowski (1993) reported that eating disorders are associated with differences in hedonic responsiveness to fat among women. The EDI (Garner, Olmstead, & Polivy, 1983) is a 64-item survey that assesses eating pathology, as well as, general psychological characteristics that differentiate eating disordered individuals from normal-weight individuals. The EDI contains eight subscales including drive for thinness, bulimia, ineffectiveness, perfectionism, body dissatisfaction, maturity fears, mistrust, and interoceptive awareness (see Appendix F).

The three subscales that have been most consistently correlated with eating disordered behaviors in normal weight individuals include the drive for thinness, bulimia, and body dissatisfaction subscales. For the purposes of this investigation, only the bulimia subscale was used because overweight women endorsed higher body dissatisfaction than female anorexic and female comparison groups (Garner, Olmstead, & Polivy, 1983). Obese women also score similar to eating disordered individuals on the drive for thinness subscale (Garner, Olmstead, & Polivy, 1983). The bulimia subscale was used to assess for eating pathology and individuals who scored above 10.5 were excluded from participation in the current investigation (Williamson, Anderson, Jackman, & Jackson, 1995). A score of 10.5 was selected because it reflects the mean score of eating disordered individuals (Williamson, et al., 1995).

Items on the EDI are presented in a 6-point forced choice format with response choices ranging from "never" to "always." The bulimia subscale of the EDI showed good convergent and divergent validity as the scale was correlated with a measure of restraint (r=0.44), and lack of control (r=0.53), but not with more general measures of psychopathology (Garner, Olmstead, & Polivy, 1983). The bulimia subscale also showed good test retest reliability among eating disordered (Standardized Cronbach's Alpha = .90) and female comparison groups (Standardized Cronbach's Alpha = .83) (Garner, Olmstead, & Polivy, 1983). Others have found the EDI to be internally consistent measure with a stable factor structure (Raciti & Norcross, 1987).

3. **Eating Inventory**- (EI; Stunkard, & Messick, 1988). Participants were asked to complete the Eating Inventory to assess cognitive factors related to dieting. The Eating Inventory is revision of the original Three Factor Eating Questionnaire (Stunkard, & Messick, 1985) that contains three subscales including cognitive control of eating (restraint),

disinhibition, and susceptibility to hunger. The Eating Inventory is a 51-item self-report questionnaire (Appendix G) that was designed to measure the tendency to restrict food intake, disinhibition of control of eating, and perceived hunger. Alison and colleagues (1992) reported .91 test-retest reliability over a two-week period. The restraint subscale of the Eating Inventory was negatively correlated (r = - 0.46) with actual food intake (Lasessle, Tuschl, Kotthaus, & Pirke, 1989). In other words, highly restrained eaters ate fewer kilocalories than individuals who were less restrained.

2. Beck Depression Inventory II- (BDI- II; Beck, Steer, & Brown, 1996). The BDI-II is an adaptation of the original BDI (Beck, Ward, Mendelson, Mock, & Erbaugh, 1968). The BDI-II is a 21-item self-report measure designed to assess clinical levels of depression (see Appendix H). It was used to assess suicidality and to identify possible clinical depression. Dozois, Dobson & Ahnberg (1998) reported that the BDI-II demonstrated high internal reliability and reported that it was a stronger measure than the BDI with regard to factor structure. If participants scored above a cutoff of 21 on this scale (indicating clinical depression), then they were contacted for further assessment of depression and suicidality. If participants were thought to be at risk, then they would have been given appropriate referrals for mental health services in the community. Only two participants who attended the orientation sessions scored > 21 on the BDI-II, both were contacted by phone, and both revealed that they were in concurrent treatment for depression. In both of these cases, the women were on antidepressant medication that they failed to mention during the initial phone screen. Both women denied current suicidal ideation. They were excluded from participation because of concurrent antidepressant medication use that could have impacted weight status.

Taste Tests. Identical batteries of milk and pudding taste tests were conducted during baseline and at post-treatment. Milk and pudding samples were selected because people have been shown to respond differently to fat that occurs in liquid and solid foods (Drewnowski, 1993). Also, overweight women have responded positively to foods that have sugar and fat mixtures (Drewnowski & Greenwood, 1983), making pudding a good choice. In addition, milk and pudding were 2 of the stimuli used in the taste tests in both the Mattes and DELTA studies and using common stimuli across studies will facilitate comparisons across studies. The current investigation asked individuals to make their taste ratings on a 10-cm VAS instead of a 9-point likert scale like those that were used in the Mattes and DELTA studies. The VAS was used as a way to increase the potential for variability in responses, which might make the sensory tests more sensitive to potential changes. This VAS was used in a previous study that examined taste ratings of high and low fat puddings (Kalupa, 2001). Twenty-five overweight and obese women completed VAS for pudding taste tests before and after a two-week baseline period. Two-week test-retest reliability was observed in this data with r values ranging from .40 - .80 (Kalupa, 2001).

Weight loss participants received 2-rating booklets with 10-individual sheets, one spoon, and a pencil before the taste test began. They were instructed to complete one page of the rating booklet for each sample tasted (see Appendix I).

1. **Pudding Taste Test-** First, participants evaluated five different vanilla pudding samples that varied in the amount of fat they contained. Puddings were prepared with skim milk, 1% milk, 2% milk, Whole milk, and ½ and ½ dairy creamer. The pudding (Jell-O Pudding, General Foods, White Plains, NY) was prepared by mixing 90 g vanilla pudding and 500 g of the milk samples (see Appendix J). Two-three drops of yellow food coloring

were added to the 3 highest fat samples to mask appearance differences. Previous work employed similar taste test procedures (Kalupa, 2001).

Each sample was rated on sweetness, creaminess, flavor, and likeability on a separate 10-cm visual analog scales (VAS) anchored by "not at all" and "extremely." On an additional 10-cm visual analog scale (anchored with "None" and "A lot"), they indicated their desire for more of the sample. In all cases, a higher rating indicated a more positive response. The taste samples for all individuals were distributed in a randomized block fashion to minimize the potential impact of order effects. Participants were not required to eat the entire sample, but instead were asked to taste each sample and to make taste ratings. Palates were cleansed between each sample with an oral rinse of tepid spring water. The entire taste test took approximately 5 minutes to complete.

2. Milk taste tests- Participants rated five different milk samples, varying in the amount of fat they contained. Milk samples included skim milk, 1% milk, 2% milk, Whole milk, and ½ and ½ dairy creamer. Participants rated each sample for sweetness, creaminess, flavor, and likeability on separate 10-cm visual analog scales (VAS) anchored by "not at all" and "extremely." On an additional 10-cm visual analog scale (anchored with "None" and "A lot"), participants indicated their desire for more of the sample. In all cases, a higher rating indicated a more positive response. The taste samples for all individuals were distributed in a randomized block fashion to minimize the potential impact of order effects. Participants were not required to drink the entire sample, but instead were asked to try each sample. Participants were asked to cleanse their palate with an oral rinse of tepid spring water between samples. The entire taste test took approximately 5 minutes to complete.

Procedure

Participants were recruited for participation in a 6-week weight loss program from the greater Washington, D.C., metropolitan area, by newspaper ads (see Appendix K). All participants were phone screened (see Appendix A for phone screen and phone script) to determine eligibility for participation. After completion of the phone screen, a medical information packet containing a physician's consent form was mailed to each participant. Ninety-eight individuals met initial inclusion criteria, determined by the phone screen, and were invited to attend a group orientation. Several orientations were held to recruit for each cohort. There were three cohorts of three weight loss conditions (Low Fat , Fat Substitute, High Taste) run from October 2001 to June 2002.

During this first orientation, informed consent was obtained (see Appendix L), individuals were weighed, and height was determined. Participants were also instructed on the use of the Psion 3.0 A palmtop computer (Psion PLC, 1994). Participants were required to keep one week of baseline food diary information for enrollment in the study (see Appendix M for a copy of instructions for using the Psion). In addition, individuals completed the initial questionnaire packet, including the EDI and the BDI-II.

All participants were required to attend a second orientation meeting occurring approximately 7-10 days after their first orientation. During the second orientation, handheld computers were collected to assess the quality of food diary information provided. In addition, initial taste tests were conducted. Individuals who completed food diary information, questionnaire packets, taste tests, and who returned the physician's consent form were randomly assigned to one of three weight loss groups. Individuals who failed to attend both orientations and individuals who did not satisfactorily complete baseline measures were not randomized to the intervention phase of the program.

Of the ninety-eight women who consented and began the baseline procedure, sixty-one completed all baseline requirements and were randomly assigned to one of three distinct groups: the two experimental groups (LOW FAT and FAT SUBSTITUTE) or the control group (HIGH TASTE). Individuals in all groups were asked to reduce their kilocaloric intake to 1800 kilocalories for the 6-week weight loss program. Two weeks of meal plans were provided to help participants adjust to eating 1800 kilocalories. A sample 1800 kilocalorie meal plan for the FAT SUBSTITUTE condition containing 20-25% fat is attached (see Appendix N). For each condition, the meal plan was adapted to meet the specific macronutrient specifications of each of the three diets.

Overview of Weight Loss Groups

The current investigation compared 3-weight loss conditions. All groups attended a 6-week psychoeducational program based on Behavior Choice, a 13-week treatment where they were asked to restrict their total energy intake to 1800 kilocalories (Sbrocco et al., 1999). All individuals were asked to keep computerized food diaries throughout the program and all individuals were asked to record their use of fat modified foods (see Appendix E). The weight loss programs were conducted in a group format with 5-12 women in each group. Groups were led by Kimberly Kalupa, M.S., a fifth year medical psychology graduate student with four years experience co-leading cognitive behavioral weight loss groups. During the weekly meetings, topics related to eating behavior were addressed. These topics included information on reading nutritional labels, eating out, portion control, emotional eating, and relapse prevention. An outline of group topics is attached and did not differ between the groups (see Appendix O).

A subset of the groups was audio taped. A research assistant, blind to study hypotheses, reviewed the audio tapes to insure that the principal investigator did not make her expectations,

with regard to taste changes and adherence, known to the participants (see Appendix P for group leader adherence checklist). The groups did not differ on group leader adherence to the protocol. No adherence violations were reported in any of the taped treatment groups.

At each of the 6-group sessions, a research assistant assisted with weighing the group members and downloaded food diary information. Research assistants were blinded to the study hypotheses. The final session for all three groups was used to conduct post-treatment taste tests and to complete post treatment questionnaires.

The primary difference between the 3-groups was the dietary recommendations, regarding dietary fat intake. There was one control condition (HIGH TASTE) that was asked to maintain fat intake at 36%, typical of an American diet. Fat influences the flavor of our diets. Therefore, it may be easier for people to adhere to an 1800-kilocalorie diet and lose more weight if the taste of their diet was good because fat content remained the same. Individuals in this group were provided with butter, regular fat salad dressing, regular fat sour cream, and regular fat mayonnaise.

There were two experimental conditions where individuals were instructed to reduce their fat intake to 20-25%. One of the experimental conditions (LOW FAT) was instructed to not to use fat-modified discretionary fat sources. It might be that after eating a low-fat diet for a number of weeks, individuals would get used to the taste of a low-fat diet. That is, it might be possible for individuals to "learn" to like a new way of eating if given enough time to adjust. This group was provided with a detailed list of fat- modified products to avoid (see Appendix E). In addition, individuals in the LOW FAT group were provided with sugar free jam, herbed vinegar, chicken broth, and mustard.

A second experimental condition, (FAT SUBSTITUTE) was instructed to use certain fat-modified discretionary fat sources. These individuals were provided with fat-modified cream cheese, sour cream, margarine, salad dressing, and mayonnaise and instructed to use at least one of these products for a minimum of three times per day. This group was provided with a detailed list of fat-modified products to use (see Appendix E). It might be that adherence to a low-fat diet would be easier if individuals were allowed to add fat-like substances to their foods. That is, adherence to a mild kilocalorie restriction diet might be easier if individuals could improve the taste of their foods, by adding fat substitutes. Individuals in the FAT SUBSTITUTE group were provided with light versions of margarine, salad dressing, sour cream, and mayonnaise.

Weekly Feedback

Each week, research assistants, blind to research hypotheses, downloaded food diary data from the hand-held computers to provide feedback indicating each participant's current level of kilocaloric intake and macronutrient consumption. Individuals were provided with macronutrient information including the percentage of kilocalories coming from dietary fat. In addition, individuals completed a fat modified food checklist (Appendix E) each week so that adherence to their instruction regarding fat modified foods could be assessed.

Adherence Enhancement Strategies

The current study was designed to account for an estimated attrition rate of 33%. This estimation was slightly larger than the rates of attrition for weight loss programs found in the literature (25%) and larger than our past studies which have demonstrated a low rate of attrition (< 11%). Compliance enhancement strategies that we regularly use to minimize high attrition rates common among weight loss programs were employed. These strategies included

prescreening (study inclusion is contingent upon 1 week of self-monitoring data). Approximately 30% of the women who initiated the baseline period did not complete it. Once assigned to groups, subjects received individual attention and personalized feedback, which have been both shown to enhance adherence to dietary modification. In addition, the relatively small group size (< 12 participants) and the use of computerized food records that provided instant feedback might have helped program adherence.

Participants were asked to inform the group leader of absences in advance. Individuals who missed a treatment session were called the next day and a ½ hour makeup session was scheduled. Participants who were having difficulty with either the Psion or with the program requirements were invited to schedule a one-to-one session with the group leader. These sessions were used to conduct individualized problem solving to promote behavior change. These sessions were intended to supplement the program, not replace the regular group session. Subjects were paid for completing assessments and taste tests at pre- and post-treatment and for successful completion of the intervention. Successful completion of the intervention was defined as attendance at four of the six sessions.

Risks/Benefits

The risks for participation in this study were minimal. Individuals might have experienced some discomfort associated with the personal nature of some of the questions on the eating inventory. Participation required a significant time commitment including attendance at two orientation sessions, the completion of several questionnaires, attendance at six weekly weight loss sessions and two follow-up sessions. Participants were paid $40 for their completion of the questionnaires, taste tests, and the active phase of treatment. It was reasonable to expect

Power and Sample Size

The sample size for this study was selected to detect a hedonic shift of 1 (sd=2.5) on a 10- cm VAS. Effect size information was not provided in previous research that examined hedonic shift in response to dietary modification. It was calculated based on the sample size and differences found (Mattes, 1993). An estimated effect size of (Cohen's d) .65 was calculated and therefore it was reasonable to expect a large effect size for the interaction term between group, time, and fat level. The current investigation used a more conservative effect size of .40 (Cohen's d). Solo Power Analysis software was used to calculate the required sample size. The proposed final sample of 60-overweight subjects (20 per group) should have provided adequate power to detect group differences assuming an effect size of .40 (Cohen's d). Beta was set at .20 and the probability of Alpha was set at .05.

Ninety-eight overweight subjects were initially recruited to account for 33% possible attrition, as attrition is common for weight loss groups. Allowing for 33% attrition, sixty subjects could reasonably be hypothesized to complete treatment.

RESULTS

ADHERENCE DATA

Treatment Completers vs. Dropouts

Once treatment was initiated, excellent adherence was observed when dropout rates, session attendance, and food diary entries were considered. Specifically, fifty-six of the sixty-one women (91.8%) of the women who initiated treatment completed the weight loss interventions. Table 1 presents summary adherence data for each of the groups. There were no statistically significant differences among the groups in terms of percentage of treatment

completers and dropouts, χ^2 (2) = .43, ns. Similarly, excellent session attendance was observed with an average of five sessions out of the six total sessions attended by participants. There were no statistically significant differences among the groups in the number of sessions attended, F(2,56) = .65, ns.

In addition, the women consistently recorded their food intake in the computerized food diaries. On average, the participants completed 28.7 days of food diary entries out of the 35 days of treatment. Food diary entries were considered "valid" if at least 2 meals were entered and if the total kilocaloric intake was at least equal to 1000. Of the days when foods were entered into the handheld computer, 26.9 of the entries were considered valid. The differences between the groups on total number of food diary entries, (F (2,56) = .60, ns) and on the number of valid food diary entries, (F(2,56) = .62, ns) were not statistically significant.

Table 2 presents demographic data and statistical results comparing women who completed treatment and the women who dropped out of treatment. In general, the women who dropped out were more overweight, younger, and more likely to be single than the women who completed treatment. There were no differences between treatment completers and dropouts on education, ethnicity, employment status, or reported income.

Table 3 presents psychological factors for the treatment completers and the dropouts and the results of statistical tests comparing the groups. The women who dropped out of treatment reported higher rates of depression than the women who completed treatment, although the mean scores do not represent clinically significant elevations. There was also evidence that suggested potentially greater eating pathology among the women who dropped out of treatment including elevations in the drive for thinness, body awareness, body dissatisfaction , bulimia , and fear of maturity subscales on the Eating Disorders Inventory. Women who dropped out of treatment

scored higher on the body dissatisfaction scale, fear of maturity, and perfectionism subscales than the eating disordered women used to norm the scale (Garner, 1991). The Eating Inventory (EI) did not distinguish among these groups.

TREATMENT GROUP DATA

Demographic Information

Demographic information for women assigned to treatment groups is presented in Table 4. No significant differences were found between individuals assigned to the three treatment groups on age ($F(2,61) = 2.77$, ns), body mass index ($F(2,61) = .28$, ns), education ($F(2,61) = 1.68$, ns), marital status ($\chi^2(4) = 2.88$, ns), employment status($\chi^2(4) = 2.32$, ns), or average household income ($\chi^2(4) = 1.14$, ns). However, there were significantly fewer ethnic minorities in the high taste group, ($\chi^2(2) = 6.17$, $p < .05$), compared to the other treatment groups. The average participant who completed baseline was a married, 47-year old Caucasian or African American woman who had a BMI of 31kg/m^2, held a college degree (Bachelor's), worked full time, and had an annual household income greater than $70,000.

Psychological Factors

Table 5 presents mean depression (BDI), Eating Disorders Inventory subscales (EDI) and Eating Inventory subscales (EI) for women who were assigned to treatment groups. No significant differences were seen between any of the three treatment groups in depression scores on the Beck Depression Inventory, $F(2,61) = .46$, ns. The average woman assigned to the treatment groups was not depressed.

Multivariate Analysis of Variance was used to examine EDI scores across the three treatment groups. The overall model was not significant, $F(16, 104) = .72$, ns. Table 5 presents mean EDI subscale means for each of the groups. Table 6 presents a MANOVA table

summarizing EDI data for women collapsed across treatment groups. Univariate tests failed to reveal any statistically significant differences between the groups.

Multivariate Analysis of Variance was used to compare EI subscale scores across treatment groups. The overall model was not statistically significant, $F(6, 108) = 1.56$, ns. Table 7 presents a MANOVA table summarizing EI data for women in the three treatment groups. Univariate tests failed to reveal any statistically significant differences between the treatment groups on any of the EI subscales. However, there was a trend for lower disinhibition scores among the fat substitute group, compared to the low fat group. These differences are unlikely to have clinical significance because both means are below clinical "cutoff" scores.

TREATMENT EFFECTS

Weight Change

There was no significant difference in between the treatment groups in the amount of weight change that was seen between baseline and post-treatment when the effects of baseline weight and post-treatment weight were covaried out of the model, $F(2,56) = 2.04$, ns. Table 8 presents mean weight change data for each of the treatment groups. When all groups were considered, an average of 3.70 lbs was seen after the 6-week weight loss program. The observed weight loss was consistent with the expected weight loss of ½ to 1 lb/wk.

Food Diary Data

Participants used handheld computers to record food intake during baseline and throughout treatment. Fifty-eight of the 61 women assigned to treatment had useable baseline food diary information. There were no between group differences in kilocaloric intake baseline, $F(2,58) = 1.83$, ns. Figure 1 presents mean kilocaloric intake at baseline and throughout treatment. In addition, there were no statistically significant between group differences in baseline fat intake, $F(2,58) = .01$, ns. Figure 2 presents percent fat intake at baseline and throughout treatment.

To assess kilocaloric consumption at baseline and post-treatment, a 3 x 2 mixed ANOVA with one independent variable, group, and one repeated measures variable, time, was used to examine caloric intake over the course of weight loss treatment. The interaction between group and time was not statistically significant, $F(2,41) = 1.20$, ns. However, this analysis was underpowered (.25). Given the relatively small effect size observed (.05), and the significance value observed it is unlikely that this interaction is truly significant. There was no main effect of group on caloric intake, $F(2,41) = 1.93$, ns. This analysis was also underpowered (.38), but a slightly larger effect size (.09) was observed and the p value approached significance. It is possible that with more subjects, a main effect of group on kilocaloric intake might have been observed. There was a main effect of time on caloric intake, $F(1,41) = 30.04$, $p < .05$. Kilocaloric intake was lower after treatment (1616.12) than it was at baseline (2219.09). Table 8 displays mean caloric values for each of the treatment groups at baseline and post-treatment.

A 3 x 2 mixed ANOVA with one between group variable, group, and one repeated measures variable, time, was used to examine fat intake over the course of weight loss treatment. The interaction between group and time on fat intake was statistically significant, $F(2,41) =$

3.70, $p < .05$. The LOW FAT and FAT SUBSTITUTE groups had a more dramatic reduction in their fat intake than the HIGH TASTE group. There was a main effect of group on fat intake, $F(2,41) = 3.20$, $p < .05$. There was also main effect of time on fat intake, $F(1,41) = 24.58$, $p < .05$. Fat intake was lower after treatment (29.67 %) than it was at baseline (36.63 %). However, pre- to post-treatment occurred in the LOW FAT and FAT SUBSTITUTE groups. Table 8 displays mean fat percentage for each of the treatment groups at both time points.

Fat Substitute use was also monitored during treatment to determine if there was differential use across the treatment groups. Two of the groups, LOW FAT and HIGH TASTE, were asked to avoid using fat substitutes during the course of treatment. One of the groups, FAT SUBSTITUTE, was asked to try to use fat substitutes 3 times per day. Figure 3 presents mean frequency of fat substitute use among the three treatment groups at each week. A one-way ANOVA, with one between groups factor, group was used to examine the average weekly frequency of fat substitute use over the course of treatment. There were statistically significant differences between the groups in their reported fat substitute use, $F(2,56) = 10.31$, $p < .01$. Planned comparisons confirmed that the FAT SUBSTITUTE group (mean fat substitute use = 9.45) consumed fat substitutes significantly more often than their LOW FAT (3.90) and HIGH TASTE (1.62) counterparts.

Nutrition Data Summary

Excellent adherence was observed among the participants in this 6-week weight loss intervention. The participants reduced their kilocaloric intake from just over 2200 kilocalories per day to a reported average of 1616 kilocalories per day. This kilocaloric reduction showed good adherence to the recommended 1800 kilocalorie program. In addition, baseline fat intake reflected 36% of total kilocaloric intake for all of the groups. The two low fat groups, LOW

FAT and FAT SUBSTITUTE reduced their fat intake to 26.73% and 26.82% of their total kilocaloric intake, whereas the high fat group, HIGH TASTE, maintained their fat intake at 34.27% of their total kilocaloric intake. In addition, fat substitutes were used more frequently in the FAT SUBSTITUTE group than in the LOW FAT and HIGH TASTE groups. Given the excellent adherence to the various dietary components of the individual treatment groups, it was possible to examine the effects of treatment group on the various dependent variables.

Exercise Data

Participants were asked to keep a hand-written exercise log at baseline and throughout treatment. Individuals were classified as "exercisers" if they reported at least one episode of exercise during a defined week. At baseline, slightly more than half of the participants reported exercising (57.4%). Pearson Chi-Square failed to reveal significant differences between the number of exercisers in the different weight loss groups at baseline (χ^2 (2) = .26, ns). Among the exercisers at baseline, there was no significant difference in either the frequency of exercise sessions, ($F(2, 35) = .56$, $p = .58$) or in the number of minutes exercised at baseline, $F(2,35) = .11$, $p = .90$. Tables 9 and 10 present more detailed exercise data.

At post-treatment, 71% of the women in treatment reported exercising. Pearson Chi-Square failed to reveal significant differences between the number of exercisers in the different weight loss groups at post-treatment (χ^2 (2) = 2.01, ns). Tables 9 and 10 present more detailed exercise data. The increase in the percentage of women who reported exercising can be attributed to additional women in the Fat Substitute and High Taste groups reporting exercise. It may also be that some of the nonexercisers had dropped out by the end of treatment, changing the overall ratio between exercisers and nonexercisers.

Among the exercisers at post-treatment, there was no significant difference in either the frequency of exercise sessions, $F(2, 40) = .63$, ns) or in the total number of minutes exercised $F(2,40) = .50$, ns) between the three treatment groups. However, all groups experienced an increase in the average number of exercise minutes reported and in the number of exercise sessions reported at post-treatment. Table 10 presents average exercise session/week and the total number of minutes exercised/week at baseline and post-treatment for the treatment groups.

PUDDING RESULTS

ANALYTICAL STRATEGIES

All participants were asked to rate the creaminess, flavor, sweetness, likeability, and desireability of 5 pudding and 5 milk samples. The samples varied in the amount of fat that they contained and included skim milk, 1%, 2%, whole milk and ½ and ½ dairy creamer. Puddings were made with each of these five milks. Analyses were conducted separately for the pudding and milk samples. Based on correlations between the dependent variables, three of the ratings: creaminess, flavor, and sweetness were examined together in one MANOVA model and the other two ratings: likeability and desireability were examined in a separate MANOVA model. For the purposes of the current results, the combined creaminess, flavor, and sweetness ratings are collectively referred to as "taste ratings," and the combined likeability and desire ratings are referred to as "hedonic ratings."

Two separate 3 x 2 x 5 MANOVA models were conducted to examine pudding results. For both models, there was one between subjects independent variable, group (Low Fat, Fat Substitute, High Taste) and two within subjects variables, time (pre, post) and fat level (Pudding made with skim, 1%, 2%, whole milk, ½ and ½). One model examined taste ratings (creaminess,

flavor and sweetness) and the other model examined hedonic ratings (likeability and desireability).

Two separate 3 x 2 x 5 MANOVA models were also conducted to examine milk results. For both models, there was one between subjects independent variable, group (Low Fat, Fat Substitute, High Taste) and two within subjects variables, time (pre, post) and fat level (skim, 1%, 2%, whole milk, ½ and ½). One model examined taste ratings (creaminess, flavor and sweetness) and the other model examined hedonic ratings (likeability and desireability). Results for the taste and hedonic analyses are presented below.

CREAMY, FLAVOR AND SWEETNESS RATINGS OVER TIME FOR PUDDING

A 3 x 2 x 5 Multivariate Analysis of Variance (MANOVA) was used to examine taste ratings (Creaminess, Flavor, and Sweetness ratings) for pudding over time. There was one between subjects independent variable, group (Low Fat, Fat Substitute, High Taste) and two within subjects variables, time (pre, post) and fat level (Pudding made with skim, 1%, 2%, whole milk, ½ and ½).

Tables 11-13 display mean creaminess, flavor, and sweetness ratings for the three groups across treatment. Table 14 presents summarized significance values for this MANOVA. Figures 4-6 present mean creaminess, flavor, and sweetness ratings at pre and post-treatment for each of the three treatment groups.

Group x Time x Fat Level on Creamy, Flavor, and Sweetness Ratings for Pudding

The three way interaction of group x time x fat level on taste ratings for pudding was not statistically significant, $F(24,76) = 1.21$, ns. Univariate tests indicated that the interaction between group, time, and fat level on pudding creaminess ratings was not significant, $F(8,192) = .67$, ns. In addition, the interaction between group, time, and fat level on pudding sweetness did

not reach statistical significance, F(8,192) = .74, ns. However, there was a trend for an interaction between group, time, and fat level on flavor ratings for pudding, F(8, 192) = 1.78, p = .085. In other words, there was a different hedonic shift from pre to post-treatment in flavor ratings for some of the puddings among the 3 treatment groups. The highest fat pudding (½ and ½) was rated as more flavorful than the next highest fat pudding (whole milk). However, after treatment, the two highest fat puddings were rated similarly to one another on flavor ratings. It appeared as if the highest fat pudding was rated as much more flavorful than the other puddings until treatment, when the flavor ratings for the highest fat pudding drop. It also appeared as if this hedonic shift was the most dramatic in the Low Fat treatment group.

Another difference between the groups, among the pudding types and across treatment appeared within the High Taste group. Prior to treatment, the 3 mid-level fat puddings (1%, 2%, and whole) were rated similarly on flavor. After treatment, the Low Fat and the Fat Substitute groups continued to rate the mid-level fat puddings similarly to one another, but the High Taste group seemed to distinguish between the fat levels. Specifically, a more linear relationship was seen between the pudding types and the flavor ratings for the High Taste group at post-treatment, such that with increased fat content, there was a corresponding increase in flavor rating for all the puddings except the highest fat pudding.

Group x Time on Creamy, Flavor, and Sweetness Ratings for Pudding

Collapsing across fat level, multivariate tests failed to identify a significant interaction between group and time on taste ratings for pudding, F(6,94) = .90, ns. Univariate tests indicated that the interaction between group and time on pudding creaminess ratings was not statistically significant, F(2,48) = .73, ns. Similarly, univariate tests indicated that the interaction between group and time on pudding flavor ratings was not statistically significant, F(2,48) = .28, ns.

There was a trend for an interaction between group and time on pudding sweetness ratings, $F(2,48) = 2.28$, $p = .09$. After treatment, there appeared to be a tendency for lower sweetness ratings for pudding, only among the High Taste group.

Group x Fat Level on Creamy, Flavor, and Sweetness Ratings for Pudding

When all taste ratings from both time points were considered together, the significant interaction between fat level and group on taste ratings for pudding failed to reach statistical significance, $F(24,76) = .88$, ns. Univariate tests indicated that the interaction between group and fat level on pudding creaminess was not statistically significant, $F(8,192) = 1.44$, ns. In addition, univariate tests indicated that the interaction between group and fat level on pudding flavor did not reach statistical significance, $F(8,192) = 1.38$, ns. Similarly, the interaction between group and fat level on sweetness ratings was not statistically significant, $F(8,192) = 1.54$, ns.

Observed power for these analyses ranged from .62 to .68, indicating that the tests may have lacked sufficient power to find true differences. However, significance levels for these interactions did not reach the level of 'trends' and the power approximated the desired .80. Although it is possible that the group by fat level interactions were underpowered, it was likely the interaction between group and fat level on the individual taste ratings (Creamy, Flavor, and Sweetness) were simply not significant. That is, when considering both pre- and post-treatment time points, the different treatment groups did not rate the 5 different pudding types differently from one another.

Fat Level x Time on Creamy, Flavor, and Sweetness Ratings for Pudding

When all three taste ratings were considered for all groups, the interaction between fat level and time on pudding taste ratings was statistically significant, $F(12,37) = 2.92$, $p < .05$.

Taste ratings (Creaminess, Flavor, and Sweetness), when considered together, were lower after treatment than taste ratings at pre-treatment, particularly for the highest and lowest fat puddings. Univariate tests indicated that the interaction between fat level and time on pudding creaminess ratings approached statistical significance, $F(4,192) = 2.28$, $p = .06$. In addition, the interaction between fat level and time on pudding flavor ratings was statistically significant, $F(4, 192) = 3.23$, $p < .05$. However, the interaction between fat level and time on pudding sweetness ratings was not statistically significant, $F(4,192) = .86$, ns.

Main Effect of Group on Creamy, Flavor, and Sweetness Ratings for Pudding

In addition, multivariate tests revealed a significant main effect of group membership on taste ratings, $F(6,94) = 2.56$, $p < .05$. Univariate tests revealed a trend for a main effect of group on Creaminess ratings, $F(2,48) = 2.40$, $p = .10$ and a significant main effect of group on Sweetness ratings, $F(2,48) = 4.50$, $p < .05$. Post Hoc analyses also revealed a non-significant trend for higher creaminess ratings among the Low Fat group than the creaminess ratings of the High Taste group (Tukey's HSD = .96, $p = .08$). Post Hoc analyses also revealed that the Low Fat group rated the puddings as significantly sweeter than the Fat Substitute group (Tukey's HSD = 1.03, $p < .05$), and sweeter than the High Taste group (Tukey's HSD = .92, $p = .057$). Univariate tests failed to reveal a main effect of group on Flavor ratings, $F(2,48) = .97$, ns.

Main Effect of Time on Creamy, Flavor, and Sweetness Ratings for Pudding

Multivariate tests did not find a main effect of time on taste ratings, $F(3,46) = 1.67$, ns. However, univariate tests revealed a significant main effect of time on creaminess ratings, $F(1,48) = 4.41$, $p < .05$. From pre-treatment to post-treatment, a drop in creaminess ratings occurred. There was a trend for a main effect of time on flavor ratings, $F(1,48) = 3.84$, $p = .056$.

Lower flavor ratings were seen after treatment. Univariate tests revealed that there was no main effect of time on Sweetness ratings, $F(1,48) = 1.45$, ns.

Main Effect of Fat Level on Creamy, Flavor, and Sweetness Ratings for Pudding

Multivariate test found a significant main effect of fat level on taste ratings, $F(12,37) = 8.74$, $p < .01$. Univariate tests revealed a significant main effect of fat level on creaminess ratings, $F(4,192) = 33.93$, $p < .01$. As the fat concentration increased, higher creaminess ratings were reported. Univariate tests also revealed a significant main effect of fat level on flavor ratings, $F(4,192) = 22.89$, $p < .01$. Higher flavor ratings were reported with the higher fat puddings. Univariate tests revealed a main effect of fat level on sweetness ratings, $F(4,192) = 2.73$, $p < .05$. As the fat concentration increased, higher sweetness ratings were reported.

Summary of Taste Ratings (Creamy, Flavor, and Sweetness) for pudding

In sum, hedonic shifts over the course of treatment did not differentiate between the treatment groups. It appears as though hedonic shifting did not occur as a result of fat intake, at least not during this 6-week time frame. This can be stated with some confidence due the high levels of adherence seen to the kilocaloric, fat intake, and fat substitute guidelines in each of the groups. It was however, possible that this study lacked sufficient statistical power to identify potential differences. For the multivariate group by time interaction term, observed power was only .49 and the univariate interaction terms showed a range of power from .09 to .49. It would be difficult to find differences with these low levels of power.

Although differential hedonic shifts did not occur between the groups, some hedonic shifts did occur over the course of treatment. For all the groups, lower creaminess and flavor ratings were seen after treatment. Women were able to distinguish between the puddings with different fat concentrations. Specifically, puddings with higher fat concentrations were rated as

creamier, more flavorful, and sweeter than puddings with lower fat concentrations. Some between group differences in taste ratings were seen. The Low Fat group tended to rate the puddings as creamier than the High Taste group and the Low Fat group tended to rate the puddings as sweeter than the Fat Substitute groups.

PUDDING LIKEABILITY AND DESIREABILITY RATINGS OVER TIME

A 3 x 2 x 5 Multivariate Analysis of Variance (MANOVA) was used to examine hedonic ratings (Likeability and Desire) for pudding before and after treatment. There was one between subjects independent variable, group (Low Fat, Fat Substitute, High Taste), one within subjects variable, time (pre, post) and another within subjects independent variable, fat level (Pudding made with skim, 1%, 2%, whole milk, ½ and ½).

Tables 15 and 16 display mean likeability and desireability ratings for the three groups across treatment. Table 17 presents summarized significance values for this MANOVA. Figures 7 and 8 present likeability and desireability ratings at pre and post-treatment for each of the three treatment groups. Multivariate tests reveal that the overall model was significant.

Group x Time x Fat Level on Likeability and Desireability Ratings for Pudding

The three way interaction of group x time x fat level on hedonic ratings (likeability and desire) for pudding was not statistically significant, $F(16,88) = .91$, ns. Univariate tests failed to reveal a significant interaction between group, time, and fat level on pudding likeability ratings, $F(8,200) = 1.22$, ns. Similarly, the interaction between group, time and fat level on pudding desireability did not reach statistical significance, $F(8,200) = 1.12$, ns. Observed power for these analyses ranged from .51 to .57 and may have been insufficient to identify true group differences. Pre- and post-treatment likeability, and desireability ratings of pudding containing different fat levels, did not change differentially between treatment groups.

Group x Time on Likeability and Desireability Ratings for Pudding

When puddings of all fat levels were considered together, the interaction between group and time on pudding hedonic ratings was not statistically signficant, F(4,100) =.69, ns. In addition, univariate analyses indicated the interaction between group and time on pudding likeability was not statistically significant, F(2,50) = .28, ns. Similarly, the interaction between group and time on pudding desireability was not statistically significant, F(2,50) = .21, ns. In other words, when all pudding types were considered together, there were no differences between the treatment groups in their hedonic ratings of puddings from pre- to post-treatment. However, this set of analyses was severely underpowered (.08 - .22), and it was therefore unlikely that the tests would be able to detect relevant differences.

Group x Fat Level on Likeability and Desireability Ratings for Pudding

Multivariate tests failed to reveal a significant interaction between fat level and group on pudding hedonic ratings, F(16,88) = .93, ns. Univariate tests indicated that the interaction between group and fat level on likeability ratings was not statistically significant, F(8,200) = .48, ns. Similarly, the interaction between group and fat level on pudding desireability ratings was not statistically significant, F(8,200) = 1.02, ns. The treatment groups did not differentially rate likeability and desireability ratings across the pudding types.

Fat Level x Time on Likeability and Desireability Ratings for Pudding

When hedonic ratings were examined across all groups, the interaction between fat level and time on pudding hedonic ratings was statistically significant, F(8,400) = 2.19, p < .05. Univariate tests identified a statistically significant interaction between fat level and time on pudding likeability ratings, F(4,200) = 3.19, p < .05. In addition, the interaction between fat level and time on pudding desireability ratings was also statistically significant, F(4,200) = 3.79,

$p < .05$. The significant interaction between fat level and time on hedonic ratings for pudding, can be accounted for by the effects of this interaction on the desireability ratings. desireability ratings were lower after treatment, particularly for the lowest fat and highest fat puddings.

Main Effect of Group on Pudding Likeability and Desireability Ratings

Multivariate tests failed to reveal a significant main effect of group membership on taste ratings, $F(4,100) = 1.64$, ns. Univariate tests failed to reveal a main effect of group on pudding likeability ratings, $F(2,50) = .22$, ns, and failed to reveal a main effect of group on pudding desireability ratings $F(2,50) = .72$, ns.

Main Effect of Time on Pudding Likeability and Desireability Ratings

When all groups and all fat levels were considered together, the model indicated a non-significant trend for a main effect of time on pudding likeability and desireability ratings, $F(2,49)= 2.70$, $p = .077$. When considered together, pudding likeability and desireability ratings tended to be lower after treatment than they were before treatment. Univariate tests failed to reveal a significant main effect of time on pudding likeability, $F(1,50) = 2.05$, ns and failed to reveal a significant main effect of time on pudding desireability, $F(1,50) = .034$, ns.

Fat Level on Pudding Likeability and Desireability Ratings

There was a significant main effect of fat level on the pudding likeability and desireability ratings, $F(8,43) = 8.78$, $p < .05$. Univariate tests revealed a significant main effect of Fat level on pudding likeability ratings, $F(4,200)=18.15$, $p < .05$, and revealed a significant main effect of Fat level on pudding desireability ratings, $F(4,200) = 20.08$, $p < .05$.

Summary of Pudding Hedonic Ratings (Likeability and Desireability)

In sum, shifts in pudding likeability and desireability ratings over the course of treatment, did not differentiate between the treatment groups. Treatment groups did not differ from one

another in their hedonic ratings, although all groups tended to rate likeability and desireability as lower after treatment. This tendency was most dramatic when desireability ratings for the highest and lowest fat puddings were considered. Women were able to distinguish between the puddings with different fat concentrations. Specifically, puddings with higher fat concentrations were rated as more liked and desired than puddings with lower fat concentrations.

MILK RESULTS

CREAMY, FLAVOR AND SWEETNESS RATINGS OVER TIME

A 3 x 2 x 5 Multivariate Analysis of Variance (MANOVA) was used to examine taste ratings (Creaminess, Flavor, and Sweetness ratings) for milk over time. There was one between subjects independent variable, group (Low Fat, Fat Substitute, High Taste), and two within subjects variables, time (pre, post) and fat level (Skim milk, 1%, 2%, whole milk, ½ and ½). Tables 18-20 display group means for creaminess, flavor, and sweetness ratings across treatment. Table 21 presents summarized significance values for this MANOVA. Figures 9-11 present mean creaminess, flavor, and sweetness ratings at pre and post-treatment for each of the three treatment groups.

Group x Time x Fat Level on Creamy, Flavor, and Sweetness Ratings for Milk

The overall MANOVA model indicated that the three way interaction of group x time x fat level was not significant, $F(24,82) = .89$, ns. Univariate analyses revealed that the 3 way interaction between group, time, and fat level on creaminess ratings also failed to reach statistical significance, $F(8, 204) = 1.02$, ns. In addition, univariate analyses failed to reveal a significant 3-way interaction between group, time, and fat level on Flavor ratings, $F(8,204) = 1.30$, ns. Similarly, the 3-way interaction between group, time, and fat level on milk sweetness ratings failed to reach statistical significance, $F(8,204) = .69$, ns. In other words, shifts in taste ratings

from pre to post-treatment, across various milk samples did not differentiate the 3 treatment groups. The overall model might have been slightly underpowered as its power estimate was .67. Given the relatively large effect size estimated (eta^2 = .21), and the lack of statistical significance observed, it is unlikely that the model failed to detect true differences.

Group x Time on Creamy, Flavor, and Sweetness Ratings for Milk

When taste values were examined for all the fat levels together, the model found that the interaction between group and time on milk taste ratings failed to reach statistical significance, $F(6,100) = 1.56$, ns. Univariate analyses indicated that the interaction between group and time on milk creaminess ratings did not reach statistical significance, $F(2,51) = .634$, ns. Similarly, univariate analyses failed to reveal a significant interaction between group and time on milk flavor ratings, $F(2,51) = .44$, ns or on milk sweetness ratings, $F(2, 51) = .30$, ns. It was unclear if there were group differences in hedonic shifts from pre- to post-treatment as each of the group x time interactions was underpowered (range .09 - .59).

Group x Fat Level on Creamy, Flavor, and Sweetness Ratings for Milk

Collapsing across time, there was a trend for a significant interaction between fat level and group on taste ratings, $F(24,82) = 1.52$, $p = .084$. Univariate tests failed to reveal a significant interaction between group x fat level on creaminess, ($F(8,204) = 1.04$, ns), or flavor ratings ($F(8,204) = 1.26$, ns). There was a trend for a significant interaction between fat level and group on sweetness ratings, ($F(8,204) = 1.74$, $p = .09$). Low Fat group members tended to rated the highest fat milk and the 2% milk as sweeter than the other group members. In addition, higher sweetness ratings were seen among the fat substitute group for the whole milk.

Fat Level x Time on Creamy, Flavor, and Sweetness Ratings for Milk

When ratings for all groups were examined together, the interaction between fat level and time was statistically significant, $F(12,40) = 2.11$, $p < .05$. Creaminess, flavor, and sweetness ratings were lower after treatment. Univariate tests indicated a significant interaction between fat level and time on milk creaminess ratings, $F(4,204) = 4.23$, $p < .05$. 2% milk and whole milk were rated as more creamy after treatment, but 1% milk was rated as less creamy after treatment. Univariate tests failed to reveal a significant interaction between fat level and time on flavor ratings for milk, $F(4,204) = 1.01$, ns. However, univariate tests did reveal a significant interaction between fat level and time on sweetness ratings, $F(4,204) = 2.49$, $p < .05$. This interaction could be accounted for by the increase in sweetness ratings for 2% milk after treatment.

Main Effect of Group on Creamy, Flavor and Sweetness Ratings for Milk

There was no main effect of group on milk taste ratings, $F(6,100) = .62$, ns. Univariate tests indicated that there was no main effect of group on milk creaminess ratings, ($F(1,51) = 1.28$, ns). There was no main effect of group on milk flavor ratings, $F(1,51) = .37$, ns. Similarly, there was no main effect of group on milk sweetness ratings, ($F(1,51) = .61$, ns). It was unclear if there were rating differences between the groups, as these tests were underpowered (range .11 - .27).

Main Effect of Time on Creamy, Flavor, and Sweetness Ratings for Milk

There was no main effect of time on milk taste ratings, $F(3,49) = 1.26$, ns. Univariate tests indicated that there was no main effect of time on creaminess ratings, $F(1,51) = .00$, ns. Similarly, there was no main effect of time on flavor ratings, $F(1,51) = .33$, ns. Univariate tests revealed that there was no main effect of time on sweetness ratings, $F(1,51) = .23$, ns. Overall,

taste ratings for milk did not differentiate between the treatment groups. It was unclear if there were rating differences from pre- to post-treatment, as these tests were underpowered (range .05-.30).

Main Effect of Fat Level on Creamy, Flavor, and Sweetness Ratings for Milk

When all groups and both times were considered, there was significant main effect of fat level on taste ratings, $F(12,40) = 13.65$, $p < .01$. In general, taste ratings tended to be higher as fat level increased. In addition, univariate tests revealed a significant main effect of fat level on creaminess ratings, $F(4,204) = 42.07$, $p < .01$. As the fat concentration increased, higher creaminess ratings were reported. Univariate tests also revealed a significant main effect of fat level on flavor ratings, $F(4,204) = 20.32$, $p < .01$. Higher flavor ratings were reported with the higher fat milk. Univariate tests revealed a main effect of fat level on sweetness ratings, $F(4,204) = 9.71$, $p < .01$. As the fat concentration increased, higher sweetness ratings were reported. Women in all of the groups were able to detect differences between the milks of various fat levels. In general, taste ratings improved with increasing fat levels.

Summary of Milk Taste Ratings

Women in all of the groups were able to detect differences between the milks of various fat levels. In general, taste ratings improved with increasing fat levels. Changes in taste ratings from pre to post-treatment, across various milk samples did not differentiate the 3 treatment groups.

MILK LIKEABILITY AND DESIREABILITY RATINGS OVER TIME

A 3 x 2 x 5 Multivariate Analysis of Variance (MANOVA) was used to examine hedonic ratings (Likeability and Desire) for pudding before and after treatment. There was one between subjects independent variable, group (Low Fat, Fat Substitute, High Taste), and two within

subjects variables, time (pre, post) and fat level (skim milk, 1%, 2%, whole milk, ½ and ½). Tables 22 and 23 display mean likeability and desireability ratings for the three groups across treatment. Table 24 presents summarized significance values, observed power, and estimated effect sizes for this MANOVA. Figure 12 and 13 present likeability and desireability ratings at pre and post-treatment for each of the three treatment groups.

Group x Time x Fat Level on Likeability and Desireability Ratings for Milk

Multivariate tests revealed that the overall model was significant. The three way interaction of group x time x fat level on milk hedonic ratings was significant, $F(16,92) = 1.72$, $p < .05$. Univariate tests indicated that the 3-way interaction on desireability ratings was also statistically significant, $F(8,208)= 2.25$, $p < .05$. Similarly, there was a trend for an interaction between group, time, and fat level on likeability ratings, $F(8,208) = 1.93$, $p = .056$. In summary, there were differential hedonic shifts across the milk types, between groups over treatment. Groups differentially rated the likeability and desireability of whole milk after treatment. The fat substitute group liked and desired the whole milk after treatment, but the high taste group liked and desired the whole milk less after treatment.

Group x Time on Likeability and Desireability Ratings for Milk

The interaction between group and time on milk hedonic ratings was not statistically significant, $F(4,104) =.96$, ns. Similarly, the univariate analyses failed to identify a significant interaction between group and time on likeability, $F (2,52) = .58$, ns or on desire for more milk, $F (2,52) = .76$, ns. In general, hedonic ratings for the milk samples were relatively low. Data indicate that average likeability and desireability ratings did not differ between the three treatment groups. However, true group differences might not have been detected by the present investigation, as power obtained for the group by time tests ranged from .14 to .30.

Group x Fat Level on Likeability and Desireability Ratings for Milk

The interaction between fat level and group on milk hedonic ratings was not statistically significant, $F(16,92) = .60$, ns, indicating that the different groups did not react differentially to the milks of varying fat levels. Univariate tests failed to identify a significant interaction between fat level and group on likeability ratings for milk, $F(8,208) = .76$, ns. Similarly, univariate tests failed to identify a significant interaction between group and fat level on desireability ratings, $F(8,208) = 1.14$, ns. It is unclear if true group difference were present, but not detected, by the current power that was observed for this interaction (range .35 -.52).

Fat Level x Time on Likeability and Desireability Ratings for Milk

However, the multivariate tests indicated that the interaction between fat level and time was statistically significant, $F(8,45) = 2.73$, $p < .05$. Likeability and desireability ratings were lower after treatment for the lower fat milks. Univariate analyses indicated that the interaction between fat level and time on desireability ratings was statistically significant, $F(4,208) = 3.64$, $p < .01$. There was also a trend for an interaction between fat level and time on likeability ratings for milk, $F(4,208) = 2.20$, $p = .07$.

Main Effect of Group on Likeability and Desireability Ratings for Milk

There was no main effect of group membership on taste ratings, $F(4,104) = .43$, ns. Univariate tests failed to reveal a main effect of group on likeability ratings, $F(2,52) = .22$, ns, and failed to reveal a main effect of group on desireability ratings $F(2,52) = .09$, ns. However, these analyses were seriously underpowered with observed power ranging from .06 to .15 and might have failed to detected true group differences.

Main Effect of Time on Likeability and Desireability Ratings for Milk

There was no main effect of time on likeability and desireability ratings, $F(2,51)= .62$, ns. Univariate tests failed to reveal a significant main effect of time on likeability, $F(1,52) = 1.24$, ns and failed to reveal a significant main effect of time on desireability, $F(1,52) = 1.07$, ns. These analyses were also underpowered (range .15- .19) and might have failed to reflect true group differences.

Main Effect of Fat Level on Likeability and Desireability Ratings for Milk

However, there was a significant main effect of fat level on the likeability and desireability ratings, $F(16,92) = 3.16$, $p < .05$. Univariate tests revealed a significant main effect of fat level on likeability ratings, $F(4,208)=7.69$, $p < .05$ and revealed a significant main effect of Fat level on desireability ratings, $F(4,208) = 7.50$, $p < .05$. For the milk samples, higher fat levels led to higher likeability and desireability ratings.

Summary of Milk Hedonic Ratings

In summary, there were differential hedonic shifts across the milk types, between groups over treatment. These shifts did not occur in the hypothesized direction. It was hypothesized that the Low Fat group would experience an increase in hedonic ratings for lower fat milk and a decrease in hedonic ratings for higher fat milk. The other two groups who maintained their exposure to fat or fat-like substances were hypothesized to have similar hedonic ratings pre- to post-treatment. Instead, what was seen was a general decrease in the likeability and desireability of low fat milks across all the treatment groups. In addition, some of the groups differentially rated the likeability and desireability of whole milk after treatment. The Fat Substitute group liked and desired the whole milk more after treatment, but the high taste group liked and desired the whole milk less after treatment.

In general, likeability ratings for the milk were fairly low. Clinical observations suggested that many of the women in treatment were not habitual milk drinkers. In fact, despite the fact that the phone screen contained questions about food allergies, several of the women in the treatment groups reported at least mild lactose intolerance. Future studies should consider using non-milk based products for taste tests. It seemed that after treatment, 2% milk had somewhat greater acceptability than the other milks. This finding suggests that 2% milk might be a good place to start for women who have not been milk drinkers, but are looking to start.

DISCUSSION

Low fat diets have been demonstrated to successfully impact a number of health outcomes (e.g., Mattes, 1998). Unfortunately, however, adherence to such diets has been notoriously difficult. The present study sought to address one potential mechanism for these adherence difficulties, fat preference. Previous work suggested that adherence difficulties in weight loss might be a result, in part, of palatability deficits imposed by low fat diets. The current investigation was based on the premise that taste changes would occur in response to dietary fat modification and that these changes would impact dietary adherence. It was hypothesized that individuals on a low fat diet would experience a hedonic shift resulting in a decrease preference for high fat foods and an increase in preference for low-fat foods. The proposed hedonic shift was hypothesized to result in greater adherence to the dietary intervention by individuals consuming a low-fat diet. The findings of this study indicate that 6-week Behavior Choice treatment has promise for weight control without changes in taste hedonics.

A modified (6 week vs. 13 week) Behavior Choice Treatment protocol was used for all groups to maximize treatment adherence. Use of this protocol versus traditional behavior therapy may have significantly impacted the findings. Treatment adherence for all groups was

excellent and exceeded expectations for all groups; 91% of participants completed treatment. These findings suggest that it may be the rules by which people govern their food-intake that are crucial to promote adherence and that these rules may supercede diet composition in importance.

Examining adherence to the low fat diet in the current investigation suggests that women were able to adjust to a new, healthy way of eating even when their preference for fat remained unchanged. Again, these findings are quite surprising given the large literature over the past two and a half decades documenting adherence difficulties to low fat diets. These data suggest that it may not be diet composition *per se* but, instead, the rules by which individuals attempt to govern their food intake. As part of traditional dieting (or the dieting mentality), individuals follow a set of rigid rules that are difficult to follow. For example, they may decide that when they are dieting, they cannot have any desserts. Given that many overweight women are chronically dieting, avoiding desserts may become increasingly difficult with time. Many women report that if they eat one cookie, then they know that they will eat the entire box (disinhibition phenomenon). With Behavior Choice Treatment, individuals are taught to eat reasonable amounts of their favorite foods. Learning to incorporate small amounts of desserts into an 1800-kilocalorie diet appears to be a more realistic approach to weight loss than trying cutting back to a 1200-kilocalorie program that does not allow room for desserts and other favorite foods.

In addition to the findings on adherence, participants in all groups lost an average of 3.7 lbs over the six-week period. If, as shown in the 13-week version of BCT (Sbrocco et al, 1999, Sbrocco et al, 2001), these individuals continue to lose weight rather than regain weight, then this short-term program could have significant implications as a short-term weight management program for women in this age and weight category (BMI < 37 kg/m^2). Longer follow up is needed but these results are intriguing and could potentially lend new understanding to how to

view adherence difficulties in the context of dietary change and in other health behavior regimens.

Fat Preference: The Context of the Present Study

Despite a belief that fat preference may play a role in dietary adherence, there have been only two studies that have examined this important question (Mattes, 1993 and Guinard et al., 1999). The current study sought to address several limitations of these studies by examining the impact of dietary fat modification on fat preference in the context of three weight loss groups with overweight women. Decreases in fat preference following adherence to a low fat diet were observed by Mattes (1993). Contrary to the Mattes (1993) study, Guinard and colleagues (1999) reported that varying total fat intake did not impact sensory response to fat in taste tests. The current study differed from the Mattes (1993) and the DELTA (Guinard et al., 1999) studies in several ways and extended this work by addressing some of the conceptual and methodological problems of these two studies.

First, a larger sample was used to insure that the current investigation had adequate power to detect a medium effect size for the main study hypotheses. It was possible that with a total of only 20 participants, the DELTA (Guinard et al., 1999) study lacked adequate power to detect important group differences. Even with the observed power ranging from .60 and .90 for the three way interactions between group, time, and fat level on the taste and hedonic ratings of pudding and milk, statistically significant differences were not seen. The null finding in the current investigation regarding the three way interaction between group, time, and fat level, were not likely a result of inadequate power and suggested that adherence to a 6-week low fat diet did not cause a decrease in fat preference for the test foods.

The current investigation addressed an additional limitation of previous work involving the weight status of participants. In the current investigation, all participants were overweight, unlike the Mattes (1993) study where only one of the three groups comprised overweight participants. Evidence suggests that overweight and normal individuals experience fat in foods differently. This fact highlighted a potential confound in the Mattes (1993) study. Because the different groups in the Mattes (1993) had different weight status, the effects of weight status on changing fat preference could not be ruled out. By focusing on only overweight women, the current investigation eliminated the potential confound of differential weight status on changing fat preference.

Beyond the weight status of participants, gender was also a factor that was treated differently in the current investigation. The DELTA (Guinard et al., 1998) and Mattes (1993) studies used both men and women. The experience of taste differs across genders (e.g., Grunberg, & Straub, 1992; Kunz, 1993; Laeng, Berridge, & Butter, 1993). Using an all female sample provided more information about the impact of dietary change on fat preference in women and eliminated another potential confound.

Another strength of the current study was that the dietary interventions were more intensive than previous interventions. Weight management groups met on a weekly basis and addressed a specified series of topics. Neither the Mattes (1993), nor the DELTA (Guinard et al., 1998) study, met on a weekly basis for behavior therapy or nutrition education. In the Mattes (1993) study, participants were simply given recipes to follow and a phone number to call if they had questions and were asked on a monthly basis to record their food intake. In the DELTA study, participants were asked to eat at a study cafeteria where their foods were provided, but were not given information about the nutritional content of their food. Because of the more

intensive behavior change intervention of the current investigation, it was assumed that greater adherence to the low fat diets would be seen and that the dietary changes in fat preference might persist. As described above, use of the Behavior Choice Treatment protocol may have changed the nature of the conceptualization of adherence to low fat diets.

Taste Changes

Given the null findings of the current investigation it is important to consider the validity and reliability of the instrument used to measure taste changes. The taste rating tasks were shown to have good test-retest reliability and the measures also have good face validity. Additionally, participants were able to differentiate among the milk and pudding samples such that with increased fat levels, hedonic ratings increased in the expected direction suggesting that the measure was sensitive to taste parameters. In addition, the specific hypotheses were not made known to participants and therefore participants would not have had a reason to bias their ratings. For these reasons, it is unlikely that the null findings were due to inadequate measures.

Taste changes that occurred were subtle and did not have a noticeable impact on short-term dietary adherence. It is possible that more time on the prescribed fat levels was required to induce a change in fat preference. As part of a secondary study, the women in the current investigation were followed up at 6 and 18-weeks after the completion of treatment. If there was a delay in taste changes across the treatment groups, then these data might reveal these changes. In addition, the impact of group membership on longer-term adherence will be determined by reported fat intake and by further weight changes. Future research could examine taste ratings over the course of a longer treatment program to determine whether more time in treatment is needed to alter fat preference. The time frame of 6 weeks was chosen based on the results of Mattes(1993), who did find hedonic changes within 4 weeks.

It is also likely that fat preference was not as clearly impacted by dietary fat intake as was expected. The current findings were consistent with Guinard and colleagues (1999) who found that varying total fat intake did not impact sensory responses to fat in taste tests. Results from the current investigation and from Guinard et al. (1999) indicated that sensory factors might not be unduly influenced by modification of dietary fat intake. The major hypotheses of the current investigation had adequate statistical power and still failed to detect differences in fat perception following dietary fat modification. Therefore, hedonic shifts might not occur in response to dietary modification. Further research is needed to rule out this possibility.

It would also be important to examine the effects of dietary fat modification that do not occur in the context of a kilocaloric restriction on taste preferences. As reported earlier, one previous study found a reduction in hedonic ratings following significant dietary fat reduction (Mattes, 1993). However, one potential confound in the Mattes (1993) study was that differential changes in caloric intake occurred across the treatment conditions. That is, individuals in the low-fat conditions of his study consumed fewer kilocalories than the individuals in the high fat condition. In the current investigation, no clear hedonic shifts occured, but all groups were experiencing kilocaloric restriction. Future studies should investigate taste changes in response to dietary fat modification that does not include kilocaloric restriction.

Proposed Model

The initial model for this investigation proposed that reducing exposure to fat would lead to a reduction in dietary fat preference and that this hedonic shift would lead to enhanced adherence to an 1800-kilocalorie weight reduction program. Results indicate that short-term

changes in macronutrient composition did not cause hedonic shifts and that adherence was high in all treatment groups, despite the macronutrient requirements of the group.

One potential explanation for the high levels of treatment adherence is the treatment model itself. Behavior Choice therapy may enhance adherence to weight loss treatment through its impact on cognitive variables. Specifically, Behavior Choice therapy might reduce cognitive restraint and reduce disinhibition, which might ultimately lower the perceived value of kilocalorically dense foods. If the relative value of high fat or kilocalorie dense foods changed as a result of Behavior Choice therapy, it is reasonable to expect that participants would begin to make healthier food choices and subsequently, the might experience less eating-related guilt. Behavioral Economics refers to the application of economic principles to behavioral outcomes in order to understand the relative value of different behavioral outcomes (Tustin, 2000). Principles of Behavioral Economics have been applied to understand the relative value of various choices in cigarette smoking (e.g., Hursch, 1980; Madden & Bickel, 1999), illicit drug use (e.g., Hursch, 1991; Bickel & Marsch, 2001), and eating behavior, (e.g., Lappalainen & Epstein, 1990; Epstein & Saelens, 2000). Future research should consider using Behavioral Economics to evaluate the impact that Behavior Choice therapy has on the relative value of various foods and eating behaviors.

Limitations

There are a number of methodological limitations of the current investigation that qualify the findings. In the current investigation, the principal investigator was also the group leader. Ideally an independent clinician, blind to conditions and hypotheses, would run each group to minimize experimenter bias. Because this work was conducted as part of a doctoral dissertation, practical limitations made this impossible.

Potentially important differences between the treatment groups were seen before treatment and might have influenced treatment outcome. The Low Fat group also had more self-reported exercisers at pre-treatment. These differences might suggest greater motivation in the Low Fat group at pretreatment, relative to the other treatment groups.

Another potential limitation was the time frame of the current investigation. The current study only focused on the impact of dietary modifications on sensory experience of fat and preference for fat after a 6-week intervention. The study conducted by Guinard and colleagues (1999) utilitized a crossover design with three 8-week feeding periods, separated by 4-6 week breaks between diets. The Mattes (1993) intervention was a 12-week dietary intervention. A program length of 6-weeks was selected because Mattes (1993) reported that hedonic shifts occurred after 4-weeks. Six-weeks provided a more conservative time frame for hedonic shifts to occur and allowed time to deliver a more in-depth weight management program. It was assumed that immediate shifts in hedonic experiences of fat would impact long term dietary adherence. However, no shifts in hedonics were seen for the foods that were selected (milk and pudding). It is possible that more time on a low fat diet was needed to reduce fat preference.

There are several factors that might limit the generalizability of the current findings. The weight criterion set for this investigation was strict, allowing only for participation of overweight and moderately obese women (BMI = 25-37kg/m^2). The current findings might not extend to women who have are more overweight than the current participants, men or non-overweight individuals. In addition, this sample was an affluent and highly educated group, with the average education level being a bachelor's degree.

In addition, it is also important to consider the health status of the current participants when determining generalizability of the current results. Although the participants were all

overweight, they were quite healthy. Previous studies have used patients with a medical diagnosis (e.g., breast cancer). Such participants could be seen as more "motivated" than "otherwise healthy" overweight participants used in the current investigation. Given this fact, the present results would be more generalizable than the results of previous investigations. However, it is possible that participants in the present investigation may have been highly motivated to adhere to treatment because of health concerns. Despite the fact that participants were all healthy at the time of the study, participants were at greater risk for developing an assortment of health problems given their weight status. Fear of developing an illness or condition as a result of their weight status might have enhanced adherence to the current protocol.

The women who completed treatment consisted of individuals who may have been more motivated than the average individual seeking weight loss treatment. All of the individuals assigned to groups completed a prescreening period that included keeping a detailed food diary and included obtaining their physician's permission to participate. These tasks were time consuming and required effort prior to the beginning of the groups. About 70% of the women who were initially consented, completed the baseline requirements. As a result, the data obtained may not accurately represent all overweight women seeking treatment.

Treatment Group Differences

There were no statistically significant differences among the groups in the number of valid food diary entries, session attendance, or adherence to an 1800-kilocalorie program. Correlational analyses indicate that these adherence variables were highly correlated with *r*-values ranging from .60 to .98 suggesting shared variance among these variables. It is unclear if true differences existed between the groups on the adherence measures as the analyses for the

adherences variables were underpowered. For the attendance variable, observed power was .32 and the effect size (eta^2) was .05. Food diary entry analyses were also underpowered with the total food diary entry analysis having an observed power of only .14 and the valid food diary entry analysis observing power of .15. The observed effect sizes of the food diary analyses were small and it is unlikely that differences would be found between the groups unless large groups of participants were observed. Though the differences between the three treatment groups did not reach statistical significance, it appeared that the women in the Fat Substitute group did not fare as well as the women in the other groups. Women in the Fat Substitute group exhibited poorer adherence (more dropout, and fewer valid food diary entries) and lost less weight than the other treatment groups. Again, none of these differences reached statistical significance, but together these factors might have clinical significance for longer-term treatment outcomes. It might be that the use of fat substitutes was consistent with maintaining a "dieting" mentality. Behavior Choice was a program with the primary goal of "breaking" this mentality. The discrepancy between the cognitive message (stop dieting) and the recommended behavior (use "diet" foods) might weaken the effectiveness of the Behavior Choice Model by introducing competing demands and thereby impacting adherence. Future research could examine dietary fat modification in the context of a more traditional behavior therapy program that does not target the "dieting mentality."

There were two additional factors that distinguished the women in the Fat Substitute group from the other two groups. There were differences between the Fat Substitute group and the other groups with regard the dietary instructions and with regard to the ethnic composition. First, it was possible that the demands placed on the Fat Substitute group were higher than the demands that were placed on the other groups. Specifically, the Fat Substitute group was asked

to eat fat substitutes in addition to the other program demands. The addition of this "extra" task might have made program adherence more difficult. Five fat modified foods were provided to each of the Fat Substitute participants in order to make the transition to using fat substitutes easier. Nonetheless, it is possible that the requirements of the fat substitute group might have been more demanding than the other groups. Future studies could evaluate the acceptability of the program demands and evaluate participant reactions to using fat substitutes.

In addition, there were differences in the ethnic makeup of the treatment groups. The Fat Substitute group had more members that were ethnic minorities. Dietary literature suggests that African American women in primarily Caucasian weight management programs in university settings have less positive outcomes in weight loss treatment. Specifically, African American women have been shown to exhibit poorer adherence in terms of use of food diaries, number of sessions attended and in greater treatment dropout than Caucasian group members in predominantly Caucasian groups held at predominantly white institutions. Differences in dietary adherence between the three treatment groups might be related to a variable that is linked to ethnic minority status. That is, the potential for a third intervening variable (client trust of clinician, comfort with other group members, history of dieting, nutrition knowledge, etc.) might explain the differences between treatment groups.

Implications

All three treatment groups showed excellent adherence and given that low fat diets have been shown to have additional health benefits, it is advantageous to continue to promote low fat diets for weight loss. New research on health risk behaviors found that the two health risk behaviors most likely to co-occur were the consumption of a high fat diet and being sedentary

(Rosal et al., 2001). Perhaps, modifying one health risk behavior (such as fat intake) might have a positive impact on sedentary behavior.

Zandstra, De Graaf, Mela, and Van Staveren (2000) found that when less preferred foods were consumed repeatedly, the reported desire to eat those foods and actual intake of those foods increased. These findings indicate that increased exposure to less preferred foods might increase their acceptability. The impact of increased acceptability might enhance consumption of healthy foods after frequent exposure to those foods. Adherence to the low fat diet in the current investigation suggested that women were able to adjust to a new, healthy way of eating even when their preference for fat remained unchanged. Corle and colleagues (2001) provide further evidence that low fat diets can be achieved. Four years after the initiation of a low fat diet, women in one dietary intervention found that overall quality of life was not negatively impacted by the adoption of a low fat diet (Corle et al, 2001). Specifically, there were no reported detriments in reported taste of their diet, or in reported cost or convenience of food preparation despite dietary modification (Corle et al., 2001).

The findings of the current investigation can be used to guide clinical recommendations for overweight/obesity treatment providers. Specifically, physicians could be instructed to teach patients how to make small, maintainable changes to their diets. Patients should also be encouraged to reduce dietary fat, and should be advised to limit "added" fats given the contribution that these fats make to overall kilocaloric consumption. Components of programs that promote long term weight maintenance incorporate self monitoring (food diaries), the adoption of an exercise program, and the adoption of a low fat diet (Carmicheal, Swinburn, & Wilson, 1998). Fat substitutes should be avoided as they do not enhance, and may negatively

impact adherence to a low fat diet. Physicians should be encouraged to reward small behavioral changes and to questions (not reward) rapid weight loss.

Conclusions

The current investigation examined the impact of dietary fat modification on fat preference and found that when dietary fat is modified in the context of kilocaloric restriction, fat preferences do not change. In addition, macronutrient composition did not impact dietary adherence to a brief 6-week weight management program. Therefore, it is suggested that low fat diets are acceptable and should be recommended for overweight women in weight loss treatment. Behavior Choice Therapy promotes initial weight loss even when shortened to a 6-week intervention.

In summary, the treatment adherence observed in this study suggests that further studies of new behavior change methods are worth pursuing. The level of adherence observed, particularly in the context of a low fat diet, is surprisingly high and the present findings, along with other similar work (Sbrocco et al., 1999; Sbrocco et al., 2001) have the potential to significantly impact our conceptualization of dietary adherence and adherence in general. Future studies should compare fat preference within the context of different behavior change protocols, keeping in mind that the "default" in our culture is the "dieting mentality," which may set up individuals for failure.

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Table 1

Adherence Data

	Low Fat	**Fat Substitute**	**High Taste**	**Total**
Completed (n = 56)	20(90.9%)	17 (89.5%)	19 (95%)	56 (91.8%)
Dropout (n = 5)	2 (9.1%)	2 (10.5%)	1 (5.0%)	5 (8.2%)
Session attendance	5.35(.75)	5.06 (1.00)	5.32 (.67)	5.25 (.80)
Total diary entries	29.75 (6.80)	26.76 (11.31)	29.26 (7.96)	28.68 (8.69)
Valid diary entries	28.05(8.17)	24.82 (11.39)	27.53 (9.22)	26.89 (9.22)

Note. Dropout values are presented as raw score (percentage). All other values presented as mean (standard deviation).

Table 2

Demographic Data for Treatment Completers and Treatment Dropouts

	Treatment Completers	**Dropout**	**Statistical Test**
Body Mass Index (kg/m^2)	30.99 (3.38)	34.82 (4.50)	t(59) = - 2.37*
Age	48.57 (8.56)	32.80 (12.52)	t(59) = 1.48**
Education	16.18 (2.76)	15.00(2.44)	t(59) = .92
Marital Status			$\chi^2(2) = 5.12$, p = .08
Single, Never Married	10 (17.9%)	3 (60 %)	
Married	37 (66.1%)	2 (40%)	
Formerly Married	9 (16.1%)		
Ethnicity			$\chi^2(1) = 1.58$
Caucasian	38 (67.9%)	2 (40%)	
Ethnic Minority	18 (32.1%)	3 (60%)	
Employment Status			$\chi^2(2) = 2.46$
Full time employed	37 (66.1%)	5 (100%)	
Part time employed	9 (16.1%)		
Not employed	10 (17.9%)		
Household Income			$\chi^2(2) = 2.11$
< 40K	6 (12.0%)		
41K-60K	15 (30.0%)	3 (60%)	
>60K	29 (58.0%)	2 (40%)	

Note. Body Mass Index, Age, Education data are presented as mean (standard deviation). Other data presented as raw score (percentage). * $p < .05$, ** $p < .01$.

Table 3

Psychological Factors for Treatment Completers and Treatment Dropouts

	Treatment Completers	**Dropouts**	**Statistical Test**
BDI	6.48 (5.22)	11.80 (7.70)	t(59) = - 2.10*
EDI			F(8,52) = 2.83*
Thinness	5.11(4.40)	11.80 (6.22)	F(1,61) = 9.93**
Aware	1.54 (2.27	5.60 (4.39)	F(1,61) = 12.39**
Bulimia	1.98 (2.24)	5.80 (5.36)	F(1,61) = 10.08**
Body	17.13 (7.30)	24.60 (2.61)	F(1,61) = 5.11*
Ineffective	1.63 (2.53)	3.80 (6.30)	F(1,61) = 2.51
Fear	1.57 (2.11)	5.20 (7.19)	F(1,61) = 7.92**
Perfect	4.32 (3.35)	7.80 (4.02)	F(1,61) = 4.80*
Distrust	1.27 (1.67)	1.40 (2.07)	F(1,61) = .03
EI			F(3,54) = 1.34
Control	8.84 (3.83)	9.80 (6.10)	F(1,58) = .25
Disinhibition	9.36 (3.57)	11.00 (3.46)	F(1,58) = .97
Susceptibility	6.25 (3.23)	9.20 (3.03)	F(1,58) = 3.86

Note. Data presented as mean (standard deviation). * $p < .05$, ** $p < .01$.
BDI = Beck Depression Inventory, EDI = Eating Disorders Inventory, EI = Eating Inventory

Table 4

Demographic Data For Participants Assigned to Treatment

	Low Fat	**Fat Substitute**	**High Taste**	**Total**
Body Mass Index (kg/m^2)	31.22 (3.73)	31.60 (3.76)	31.95 (3.66)	31.58 (3.67)
Age	45.82 (9.96)	45.50 (10.22)	50.86 (7.79)	47.34 (9.59)
Education	16.00 (2.88)	15.09 (2.67)	16.67 (2.73)	15.91 (2.79)
Nutrition Data				
Kilocaloric Intake	2207.78 (726.76)	1881.85 (507.88)	2434.50 (707.36	2189.35 (688.00)
Fat Intake	36.88 (7.37)	36.55 (6.75)	36.20 (7.01)	36.54 (6.95)
Marital Status				
Single, Never Married	6 (27.3%)	5 (26.3%)	2 (10.0%)	13 (21.3%)
Married	14 (63.6%)	11 (57.9%)	14 (70.0%)	39 (63.9%)
Formerly Married	2 (9.1%)	3 (15.8%)	4 (20%)	9 (14.8%)
Ethnicity				
Caucasian	14 (63.6%)	9 (47.4%)	17 (85.0%)	40 (65.6%)
Ethnic Minority	8 (36.4%)	10 (52.6%)	3 (15.0%)	21 (34.4%)
Employment Status				
Full time employed	15 (68.2%)	15 (78.9%)	12 (60.0%)	42 (68.9%)
Part time employed	4 (18.2%)	2 (10.5%)	3 (15.0%)	9 (14.8%)
Not employed	3 (13.6%)	2 (10.5%)	5 (25.0%)	10 (16.4%)
Household Income				
< 40K	3 (15.0%)	1 (5.9%)	2 (11.1%)	6 (10.9%)
41K-60K	7 (35.0%)	6 (35.3%)	5 (27.8%)	18 (32.7%)
>60K	10 (50.0%)	10 (58.8%)	11 (61.1%)	31 (56.4%)

Note. Body Mass Index, age, education, and nutrition data (7-day average) are all presented as mean scores (standard deviation). The remainder of the demographic information is presented as raw score (percentage).

Table 5

Psychological Factors for Participants Assigned to Treatment

	Low Fat	**Fat Substitute**	**High Taste**	**Total**
BDI	7.00 (4.97)	7.36 (5.99)	5.80 (5.63)	6.74 (5.50)
EDI				
Thinness	7.28 (5.61)	3.94 (3.29)	5.50 (4.90)	5.66 (4.88)
Aware	2.59 (3.03	1.47 (2.89)	1.45 (1.99)	1.87 (2.70)
Bulimia	3.18 (3.49)	1.32 (1.95)	2.25 (2.29)	2.30 (2.76)
Body	19.27 (7.58)	15.84 (6.83)	17.85 (7.44)	17.74 (7.32)
Ineffective	2.54 (4.08)	1.63 (2.61)	1.25 (1.52)	1.80 (2.98)
Fear	2.86 (3.90)	1.26 (1.80)	1.35 (2.23)	1.87 (2.92)
Perfect	4.27 (3.45)	4.68 (3.70)	4.90 (3.54)	4.61 (3.51)
Distrust	1.18 (1.56)	1.68 (1.80)	1.00 (1.72)	1.28 (1.68)
EI				
Control	8.52 (3.67)	9.00 (4.37)	9.33 (4.17)	8.93 (4.01)
Disinhibition	10.57 (2.99)	7.95 (3.14)	9.89 (4.17)	9.50 (3.57)
Susceptibility	6.76 (3.48)	6.47 (3.10)	6.22 (3.44)	6.50 (3.29)

Note. Scores are presented as means (standard deviation).
BDI = Beck Depression Inventory, EDI = Eating Disorders Inventory, EI = Eating Inventory

Table 6

MANOVA Table: Eating Disorders Inventory (EDI) Subscales Across Treatment Groups

		F values							
		Thin	Aware	Bulimia	Body	Ineffect	Fears	Perfect	Distrust
Source	df	Between Subjects							
Group	2	2.52^	1.24	2.44^	1.13	.90	2.08	.17	.86
Error	58	(22.63)	(7.22)	(7.30)	(53.40)	(8.89)	(8.22)	(12.66)	(2.85)
Total	61								

Note. Values presented are F-test values. Values in parentheses represent mean square errors.
^ = Non-significant trend reflected by a $p < .1$ and $> .05$.

Table 7

MANOVA Table: eating inventory Subscales Across Groups

		F values		
		Control	Disinhibition	Susceptibility
Source	df	Between Subjects		
Group	2	.17	2.74	.14
Error	55	(16.55)	(11.98)	(11.19)
Total	58			

Note. Values presented are F-test values. Values in parentheses represent mean square errors.

Table 8

Nutrition Data Before and After Treatment

	Low Fat	**Fat Substitute**	**High Taste**	**Total**
BL Kcal	2224.05 (779.02)	2008.35 (526.77)	2363.47 (651.46)	2219.09 (668.68)
BL Fat %	36.47 (5.65)	37.49 (5.65)	36.17 (5.99)	36.63 (5.67)
Post-tx Kcal	1827.27 (577.77)	1409.57 (382.51)	1575.60 (310.70)	1616.12 (458.42)
Post-tx Fat %	26.73 (6.34)	26.82 (9.22)	34.27 (6.44)	29.67 (8.00)
Weight Change (lbs)	4.67 (3.63)	2.37 (3.28)	3.86 (3.05)	3.70 (3.41)

Note. Scores are presented as means (standard deviation). BL = Baseline.

Table 9

Exercise Participation

	Low Fat		**Fat Substitute**		**High Taste**	
	Baseline	Post-tx	Baseline	Post-tx	Baseline	Post-tx
Exercisers	13 (59.1%)	12 (60%)	10 (52.6%)	13 (76.5%)	12 (60.0%)	15 (78.9%)
Non-exercisers	9 (40.9%)	8 (49%)	9 (47.4%)	4 (23.5%)	8 (40.0%)	4 (21.1%)
	22	20	19	17	20	19

Note. Data presented as raw score (percentage).

Table 10

Exercise Information among the Exercisers

	Low Fat		**Fat Substitute**		**High Taste**	
	Baseline	Post-tx	Baseline	Post-tx	Baseline	Post-tx
Sessions	3.92 (2.29)	4.67 (2.19)	3.70 (2.00)	4.00 (1.41)	3.08 (1.73)	4.07 (1.28)
Total Minutes	158.46 (107.05)	218.67 (141.03)	145.02 (237.00)	173.62 (87.29)	178.33 (156.15)	190.00 (108.97)

Note. Data presented as raw score (percentage).

PUDDING TABLES

Table 11

Mean Creaminess Ratings by Group Over Time for Pudding

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Pudding	6.34(2.61)	5.43(2.48)	6.72(2.09)	5.11(2.56)	5.38(2.43)	4.48(2.77)
1% Pudding	6.46(2.50)	6.16(2.26)	6.85(2.07)	5.77(2.04)	6.50(1.82)	5.23(2.22)
2% Pudding	7.33(1.93)	6.98(1.82)	6.39(2.17)	6.30(1.58)	6.30(2.12)	6.26(2.33)
Whole Milk Pudding	7.13(2.51)	7.09(1.82)	6.63(2.30)	6.38(1.68)	6.23(1.90)	7.45(1.48)
½ and ½ Pudding	8.69(1.07)	7.90(1.89)	8.05(1.86)	7.54(1.89)	7.64(1.62)	7.42(2.04)

Note. Data presented as mean (standard deviation).

Table 12

Mean Flavor Ratings by Group Over Time for Pudding

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Pudding	5.40(2.52)	4.39(2.26)	6.64(2.02)	4.48(1.89)	5.15(2.55)	4.31(2.64)
1% Pudding	5.90(2.56)	6.25(1.92)	6.74(2.14)	6.24(2.64)	6.45(1.83)	4.82(1.98)
2% Pudding	6.96(1.77)	6.16(2.16)	6.27(2.04)	5.96(1.62)	5.99(2.26)	5.92(2.66)
Whole Milk Pudding	6.59(2.25)	6.34(2.26)	6.71(2.06)	6.03(1.22)	5.96(2.12)	7.06(2.45)
½ and ½ Pudding	8.36(1.33)	7.20(2.06)	7.30(1.79)	6.73(2.07)	7.31(1.77)	6.71(2.46)

Note. Data presented as mean (standard deviation).

Table 13

Mean Sweetness Ratings by Group Over Time for Pudding

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Pudding	6.74(2.69)	6.12(2.31)	6.61(2.43)	5.14(1.97)	5.77(2.85)	5.33(2.60)
1% Pudding	6.11(2.57)	7.02(1.89)	6.65(1.82)	5.82(2.30)	6.39(2.08)	6.24(2.32)
2% Pudding	7.25(1.70)	7.50(1.44)	5.60(2.26)	5.83(1.83)	6.09(2.27)	6.34(2.07)
Whole Milk Pudding	7.05(2.62)	7.01(1.87)	6.30(2.66)	4.96(1.86)	6.00(2.15)	6.42(2.34)
½ and ½ Pudding	7.65(1.37)	6.85(2.12)	6.39(1.79)	5.99(2.03)	6.16(1.63)	6.14(2.25)

Note. Data presented as mean (standard deviation).

Table 14

Summary Table of Significance Values for Pudding Ratings (Creamy, Flavor, Sweetness) by Group over Time

	Group Main Effect	**Time Main Effect**	**Group x Time**	**Fat Level Main Effect**	**Fat Level x Group**	**Fat Level x Time**	**Group x Time x Fat**
Overall							
p value	p=.024*	p=.188	p=.500	p=.000**	p=.628	p=.027*	p=.259
Power	(.82)	(.41)	(.34)	(1.00)	(.64)	(.89)	(.82)
eta^2	[.14]	[.10]	[.05]	[.74]	[.22]	[.43]	[.28]
Creamy							
p value	p=.102	p=.041*	p=.487	p=.000**	p=.183	p=.062	p=.715
Power	(.46)	(.54)	(.09)	(1.00)	(.64)	(.66)	(.31)
eta^2	[.09]	[.08]	[.03]	[.41]	[.06]	[.05]	[.03]
Flavor							
p value	p=.385	p=.056	p=.756	p=.000**	p=.207	p=.014*	p=.085
Power	(.21)	(.48)	(.17)	(1.00)	(.62)	(.82)	(.75)
eta^2	[.04]	[.07]	[.01]	[.32]	[.05]	[.06]	[.07]
Sweet							
p value	p=.016*	p=.235	p=.087	p=.030*	p=.145	p=.485	p=.655
Power	(.74)	(.22)	(.49)	(.75)	(.68)	(.27)	(.34)
eta^2	[.16]	[.03]	[.10]	[.05]	[.06]	[.02]	[.03]

Note. Data presented are signficance values, power (1-β), and effect size [eta^2]. For significance values, * $p < .05$ and ** $p < .01$.

Table 15

Mean Likeability Ratings by Group Over Time for Pudding

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Pudding	4.08(2.77)	3.47(2.03)	5.58(2.57)	4.26(1.95)	4.11(2.53)	3.58(2.89)
1% Pudding	5.16(2.57)	5.26(2.53)	5.78(2.85)	5.20(2.46)	5.51(1.41)	4.30(2.16)
2% Pudding	5.62(2.89)	4.99(3.26)	5.79(2.46)	5.96(1.54)	5.66(2.69)	4.74(2.98)
Whole Milk Pudding	5.67(2.11)	5.49(2.94)	5.50(2.92)	5.83(2.06)	5.46(2.47)	6.43(2.85)
½ and ½ Pudding	7.66(1.96)	5.83(3.37)	6.88(2.40)	6.53(2.60)	6.98(2.14)	5.35(3.02)

Note. Data presented as mean (standard deviation).

Table 16

Mean Desireability Ratings by Group Over Time for Pudding

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Pudding	3.27(2.64)	2.64(2.11)	4.17(2.67)	3.20(2.25)	2.83(2.80)	2.51(2.75)
1% Pudding	4.10(2.18)	4.81(2.87)	4.60(2.37)	4.37(2.42)	4.16(2.73)	3.26(2.68)
2% Pudding	4.68(3.02)	4.72(3.19)	4.65(2.69)	5.05(1.67)	4.54(2.90)	4.12(3.12)
Whole Milk Pudding	4.63(2.56)	5.35(3.07)	4.76(2.90)	4.95(2.46)	4.05(2.61)	5.22(3.68)
½ and ½ Pudding	6.85(2.71)	5.54(3.45)	6.12(2.70)	5.54(2.93)	4.93(3.11)	4.07(3.44)

Note. Data presented are mean (standard deviation).

Table 17

Summary Table of Significance Values for Pudding Ratings (Likeability and Desire) Group over Time

	Group Main Effect	**Time Main Effect**	**Group x Time**	**Fat Level Main Effect**	**Fat Level x Group**	**Fat Level x Time**	**Group x Time x Fat**
Overall							
p value	p=.170	p=.077	p=.603	p=.000**	p=.534	p=.031*	p=.561
Power	(.489)	(.511)	(.216)	(1.00)	(.582)	(.832)	(.567)
eta^2	[.06]	[.10]	[.03]	[.62]	[.15]	[.31]	[.14]
Like							
p value	p=.804	p=.159	p=.759	p=.000**	p=.873	p=.015*	p=.288
Power	(.082)	(.289)	(.091)	(1.00)	(.218)	(.819)	(.556)
eta^2	[.01]	[.04]	[.01]	[.27]	[.02]	[.06]	[.05]
More							
p value	p=.494	p=.854	p=.811	p=.000**	p=.425	p=.005**	p=.349
Power	(.164)	(.054)	(.081)	(1.00)	(.466)	(.886)	(.514)
eta^2	[.03]	[.00]	[.01]	[.29]	[.04]	[.07]	[.04]

Note. Data presented are signficance values, power (1-β), and effect size [eta^2]. For significance values, * $p < .05$ and ** $p < .01$.

MILK TABLES

Table 18

Mean Creaminess Ratings by Group Over Time for Milk

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Milk	2.79(2.36)	2.73(2.05)	3.95(2.68)	3.15(2.03)	3.25(2.52)	3.31(1.79)
1% Milk	3.90(2.74)	3.04(2.85)	4.28(2.48)	3.74(2.78)	4.15(2.61)	3.02(1.52)
2% Milk	3.77(3.07)	5.14(2.79)	4.10(2.55)	4.29(2.46)	4.48(2.55)	4.94(2.71)
Whole Milk	4.02(2.89)	4.90(2.91)	4.19(2.62)	5.43(2.33)	4.59(1.95)	3.96(2.34)
½ and ½	6.42(2.98)	5.72(2.42)	6.01(2.45)	5.79(3.01)	6.82(2.41)	6.62(2.51)

Note. Data presented as mean (standard deviation).

Table 19

Mean Flavor Ratings by Group Over Time for Milk

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Milk	3.06(2.51)	3.01(2.17)	4.37(2.57)	3.46(2.59)	3.35(1.97)	4.14(2.07)
1% Milk	4.39(2.73)	3.42(2.62)	4.63(2.45)	3.62(2.62)	3.60(2.26)	3.68(2.37)
2% Milk	4.64(2.81)	5.06(2.87)	4.40(2.27)	3.72(2.04)	4.25(2.39)	4.87(2.70)
Whole Milk	4.42(2.46)	4.97(2.73)	4.19(2.44)	4.52(2.03)	5.02(2.29)	3.87(2.48)
½ and ½	5.96(2.77)	5.50(2.51)	5.76(2.35)	5.53(2.78)	5.90(2.44)	6.23(2.77)

Note. Data presented as mean (standard deviation).

Table 20

Mean Sweetness Ratings by Group Over Time for Milk

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Milk	3.23(2.70)	3.07(2.27)	3.44(2.57)	3.38(2.38)	3.68(2.32)	3.78(2.09)
1% Milk	3.30(2.64)	3.11(2.94)	3.89(2.71)	4.09(2.80)	3.88(2.61)	3.32(2.58)
2% Milk	3.62(2.89)	5.19(2.82)	3.35(2.28)	4.04(2.78)	4.10(2.54)	4.75(2.79)
Whole Milk	4.20(2.52)	4.32(3.01)	3.50(2.79)	4.98(2.44)	4.73(2.28)	4.21(2.68)
½ and ½	5.91(3.27)	5.24(2.49)	4.21(2.66)	4.33(2.91)	5.20(2.85)	5.05(2.79)

Note. Data presented as mean (standard deviation).

Table 21

Summary Table of Significance Values for Milk Ratings (Creamy, Flavor, Sweetness) by Group over Time

	Group Main Effect	**Time Main Effect**	**Group x Time**	**Fat Level Main Effect**	**Fat Level x Group**	**Fat Level x Time**	**Group x Time x Fat**
Overall							
p value	p=.710	p=.298	p=.166	p=.000**	p=.084	p=.039*	p=.614
Power	(.239)	(.317)	(.579)	(1.00)	(.923)	(.862)	(.657)
eta^2	[.04]	[.07]	[.09]	[.80]	[.31]	[.39]	[.21]
Creamy							
p value	p=.286	p=.964	p=.535	p=.000**	p=.410	p=.003**	p=.420
Power	(.266)	(.050)	(.150)	(1.00)	(.475)	(.922)	(.314)
eta^2	[.05]	[.00]	[.02]	[.45]	[.04]	[.08]	[.04]
Flavor							
p value	p=.695	p=.569	p=.648	p=.000**	p=.268	p=.403	p=.247
Power	(.106)	(.087)	(.117)	(1.00)	(.571)	(.316)	(.587)
eta^2	[.01]	[.01]	[.02]	[.29]	[.05]	[.02]	[.05]
Sweetness							
p value	p=.548	p=.631	p=.744	p=.000**	p=.092	p=.045*	p=.704
Power	(.146)	(.076)	(.087)	(1.00)	(.742)	(.702)	(.314)
eta^2	[.02]	[.01]	[.01]	[.16]	[.06]	[.05]	[.03]

Note. Data presented are signficance values, power (1-β), and effect size [eta^2]. For significance values, * $p < .05$ and ** $p < .01$.

Table 22

Mean Likeability Ratings by Group Over Time for Milk

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Milk	2.72(2.10)	2.74(2.02)	3.95(2.22)	3.02(2.59)	3.37(2.32)	3.63(2.18)
1% Milk	4.05(2.45)	2.75(2.18)	4.11(2.19)	3.27(2.43)	3.44(2.08)	3.57(2.36)
2% Milk	4.15(2.55)	4.59(2.95)	4.43(2.59)	4.26(2.64)	3.97(2.34)	4.85(2.95)
Whole Milk	4.18(2.69)	4.32(2.46)	4.08(2.31)	4.59(2.36)	4.69(2.45)	3.15(2.10)
½ and ½	4.70(3.25)	4.19(2.82)	4.71(2.38)	4.20(3.28)	4.52(2.47)	5.27(2.88)

Note. Data presented as mean (standard deviation).

Table 23

Mean Desireability Ratings by Group Over Time for Milk

	Low Fat		**Fat Sub**		**High Taste**	
	Pre	**Post**	**Pre**	**Post**	**Pre**	**Post**
Skim Milk	2.33(2.08)	1.85(1.74)	3.00(2.46)	2.68(2.53)	2.58(2.34)	2.74(2.28)
1% Milk	3.49(2.34)	2.04(2.02)	3.64(2.14)	2.59(2.06)	2.63(2.14)	2.87(2.08)
2% Milk	3.36(2.30)	3.70(2.90)	3.29(2.10)	3.58(2.65)	2.41(1.61)	4.24(2.58)
Whole Milk	3.72(2.44)	3.56(2.75)	3.10(2.26)	4.16(2.70)	3.66(2.59)	2.44(2.29)
½ and ½	4.16(3.04)	3.65(3.01)	3.73(2.34)	3.06(2.78)	3.41(2.78)	3.86(2.82)

Note. Data presented as mean (standard deviation).

Table 24

Summary Table of Significance Values for Milk (Likeability and Desire) Group over Time

	Group Main Effect	**Time Main Effect**	**Group x Time**	**Fat Level Main Effect**	**Fat Level x Group**	**Fat Level x Time**	**Group x Time x Fat**
Overall							
p value	p=.788	p=.541	p=.431	p=.036*	p=.876	p=.015*	p=.056
Power	(.147)	(.148)	(.296)	(.935)	(.370)	(.889)	(.898)
eta^2	[.02]	[.02]	[.04]	[.36]	[.09]	[.33]	[.23]
Like							
p value	p=.805	p=.271	p=.564	p=.000**	p=.638	p=.070	p=.057
Power	(.082)	(.194)	(.141)	(.997)	(.348)	(.641)	(.796)
eta^2	[.01]	[.02]	[.02]	[.13]	[.03]	[.04]	[.07]
More							
p value	p=.915	p=.305	p=.471	p=.000**	p=.338	p=.007**	p=.025*
Power	(.063)	(.174)	(.173)	(.997)	(.522)	(.873)	(.865)
eta^2	[.00]	[.02]	[.03]	[.13]	[.04]	[.07]	[.08]

Note. Data presented are signficance values, power (1-β), and effect size [eta^2]. For significance values, * $p < .05$ and ** $p < .01$.

Figure 1.
KiloCaloric Intake of Groups Over Treatment

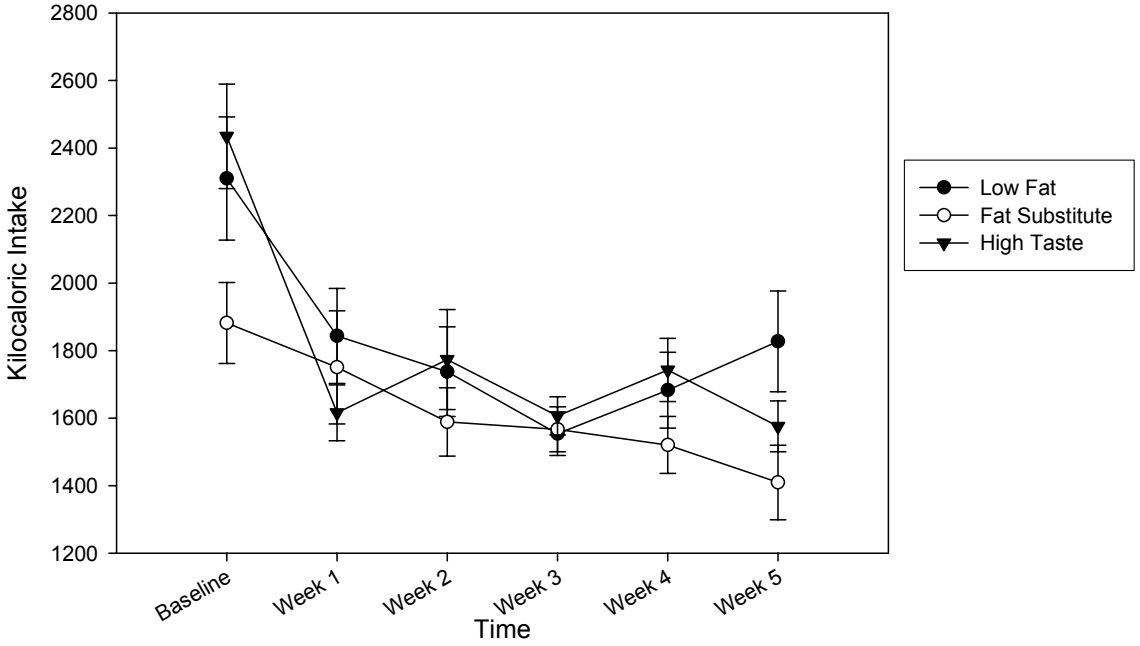


Figure 2.
Average Fat Intake of Groups Over Treatment

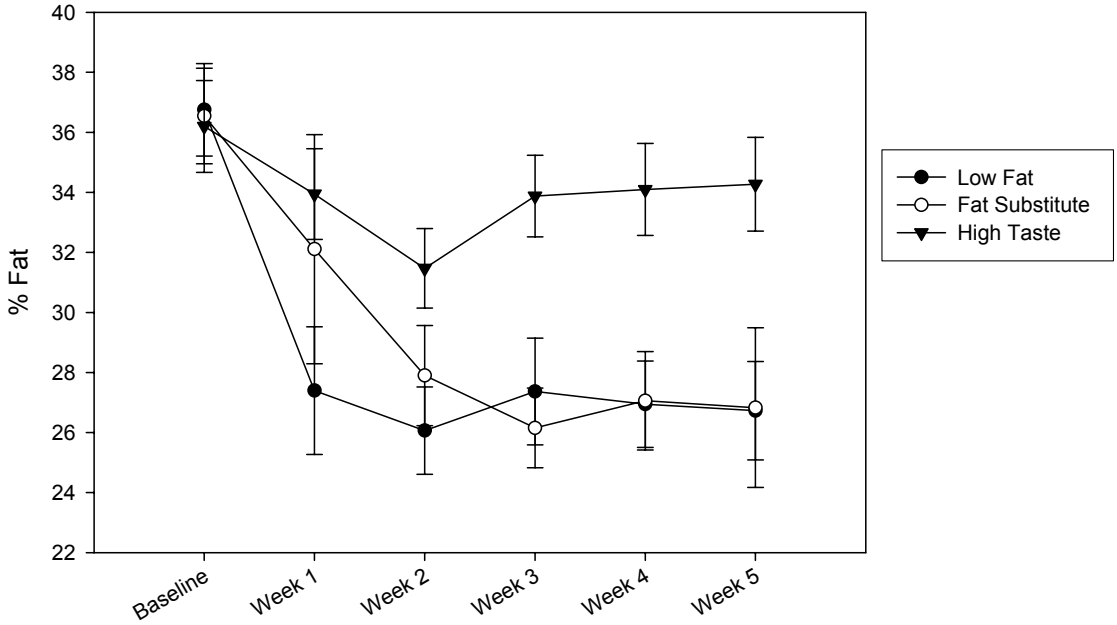
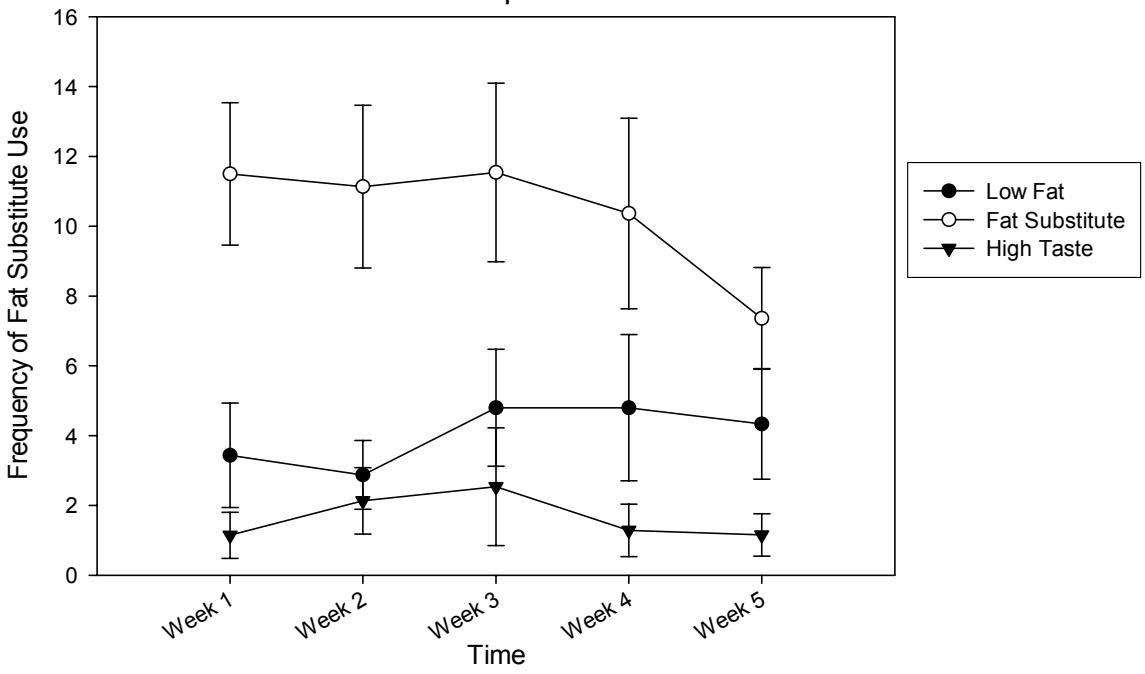


Figure 3.
Fat Substitute Intake of Groups Over Treatment



Figures 4-13 represent taste ratings and hedonic ratings for pudding and milk. The following abbreviations were used in these figures.

Skim = Skim milk or Pudding made with Skim milk
1% = 1% milk or Pudding made with 1% milk
2% = 2% milk or Pudding made with 2% milk
Whole = Whole milk or Pudding made with Whole milk
Cream = 1/2 and 1/2 dairy creamer or Pudding made with 1/2 and 1/2 dairy creamer

Figure 4.
Pudding Creaminess Ratings of Groups Over Time

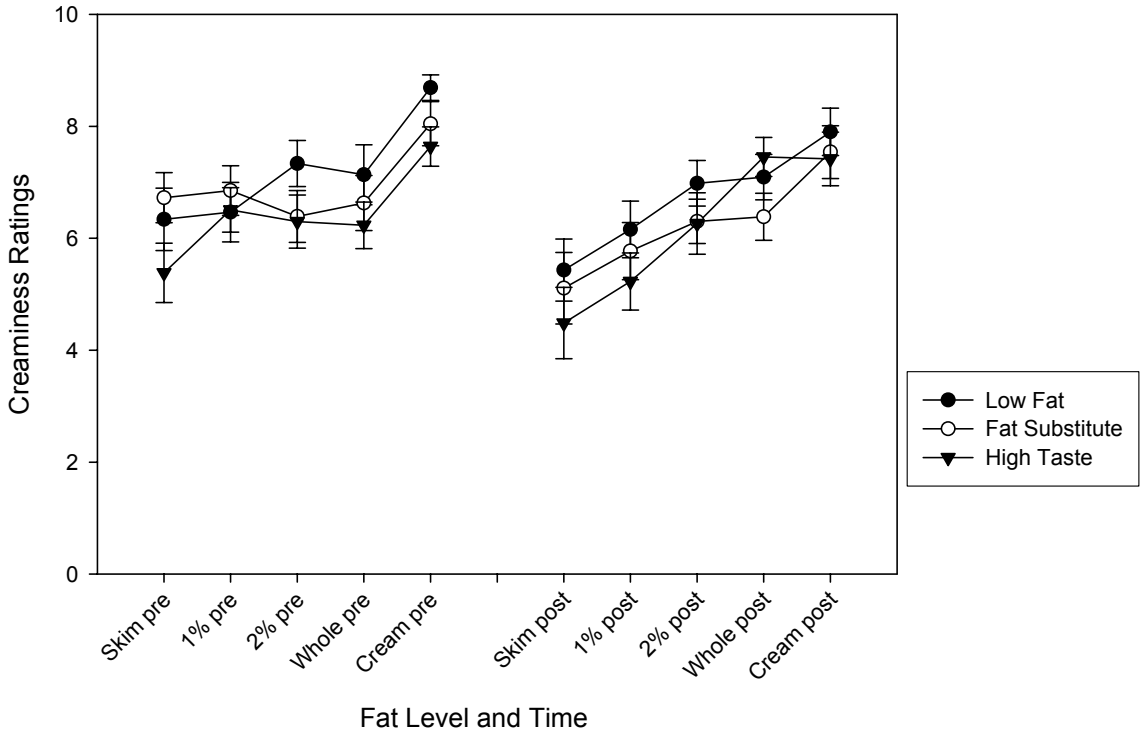


Figure 5.
Pudding Flavor Ratings of Groups Over Time

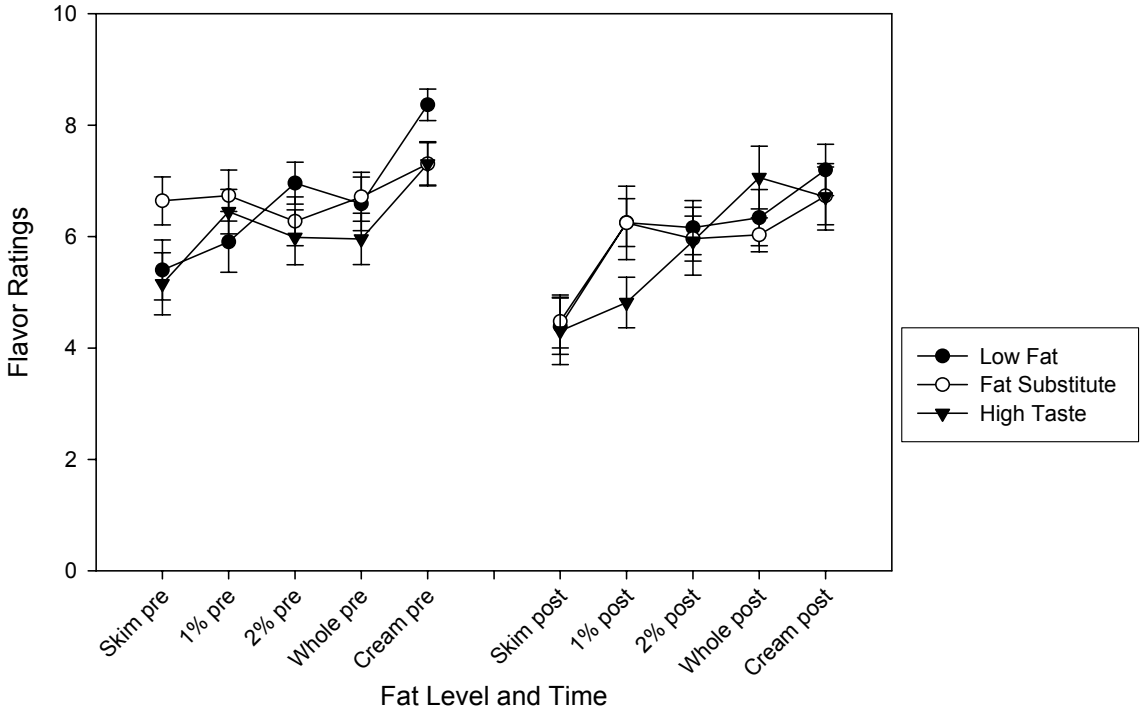


Figure 6.
Pudding Sweetness Ratings of Groups Over Time

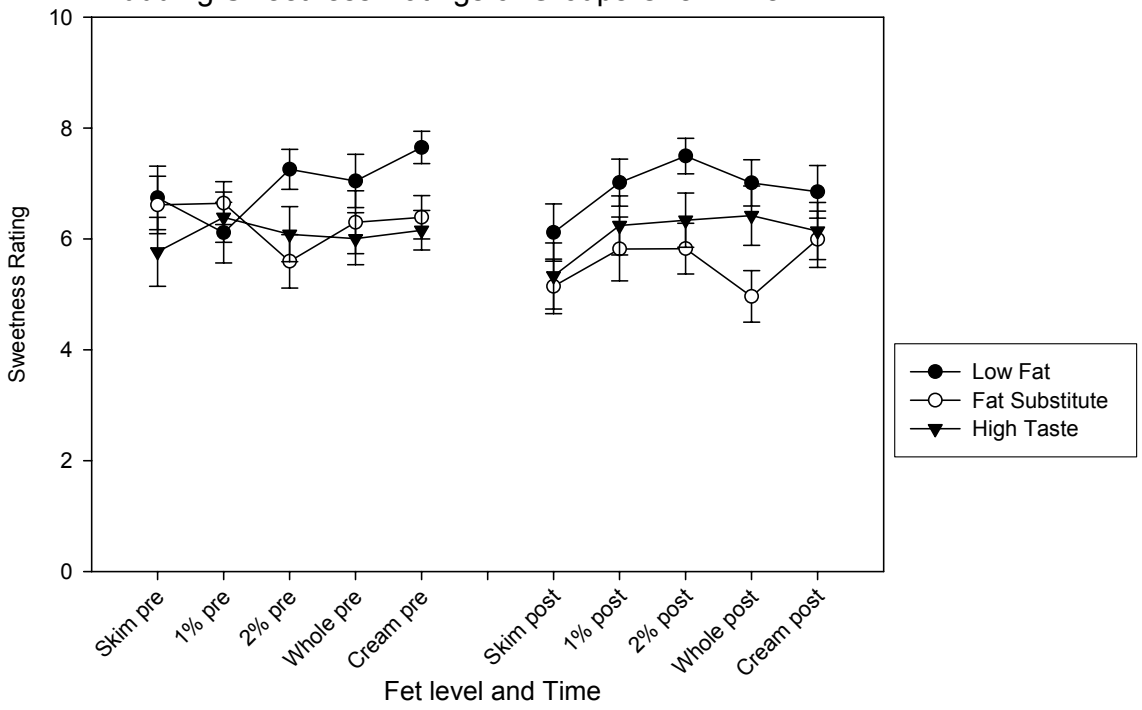


Figure 7.
Pudding Likeability of Groups Over Time

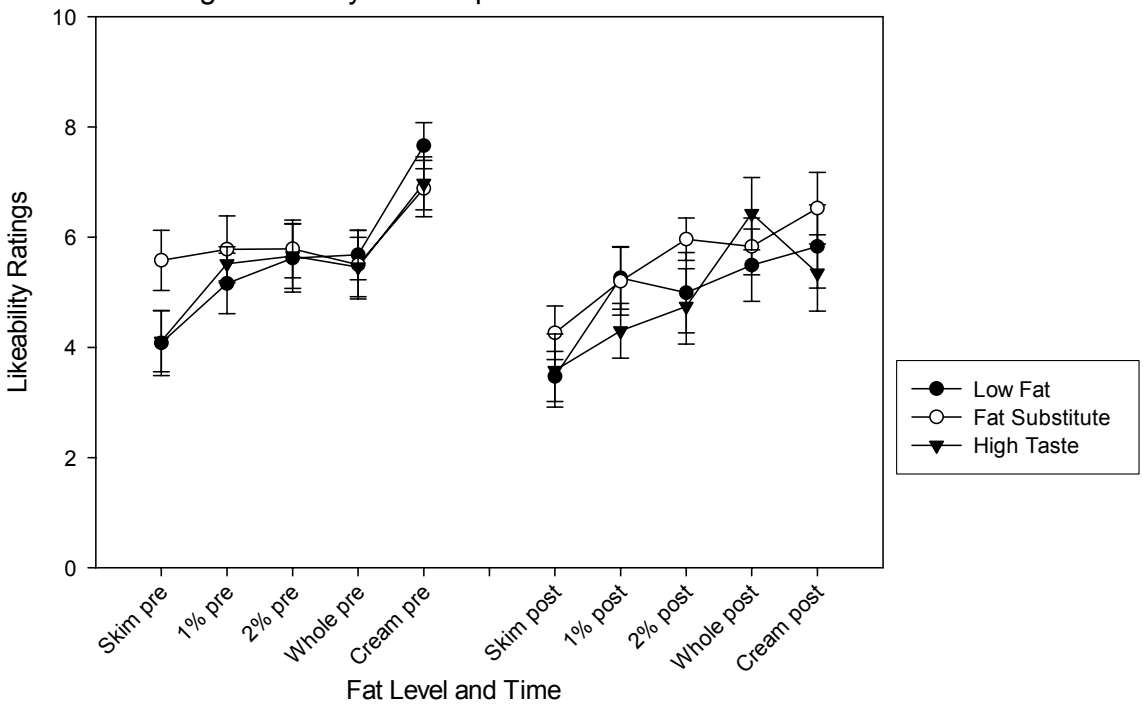


Figure 8.
Pudding Desireability of Groups Over Time

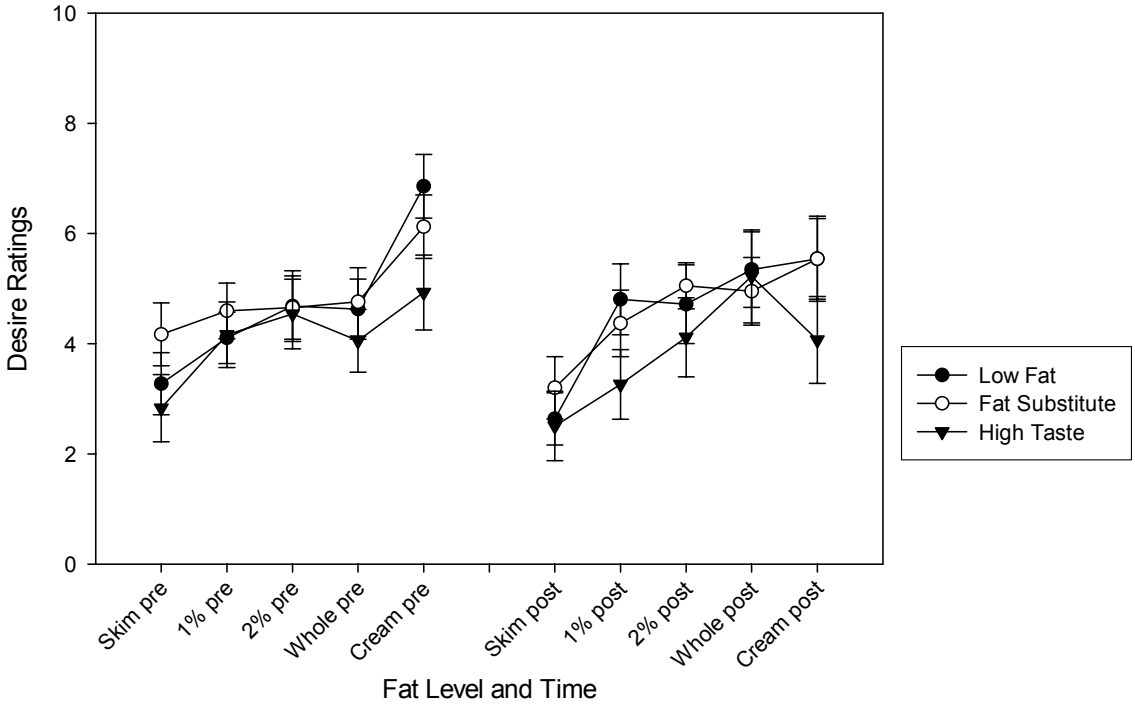


Figure 9.
Milk Creaminess Ratings of Groups Over Time

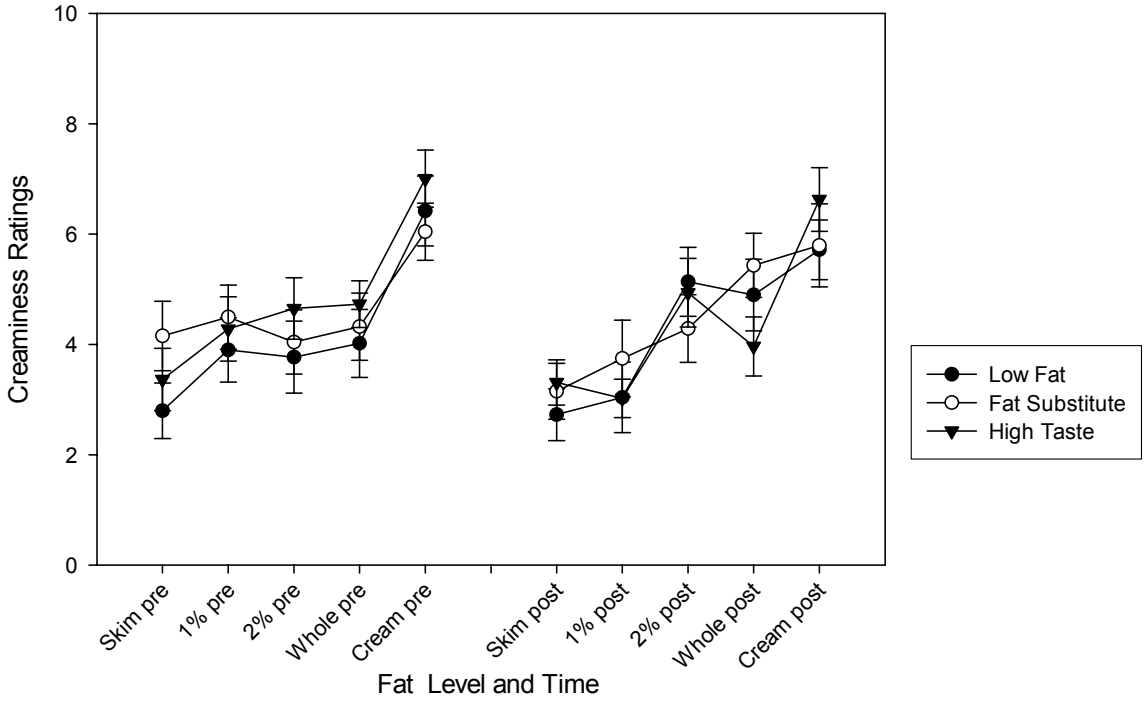


Figure 10.
Milk Flavor Ratings of Groups Over Time

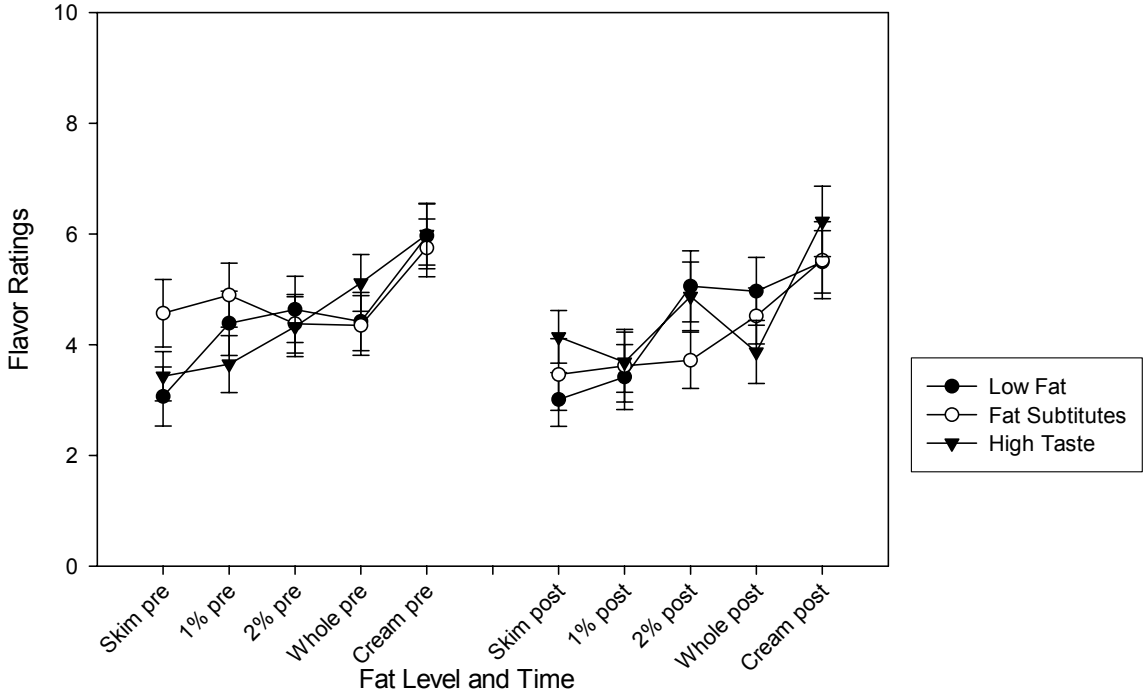


Figure 11.
Milk Sweetness Ratings of Groups Over Time

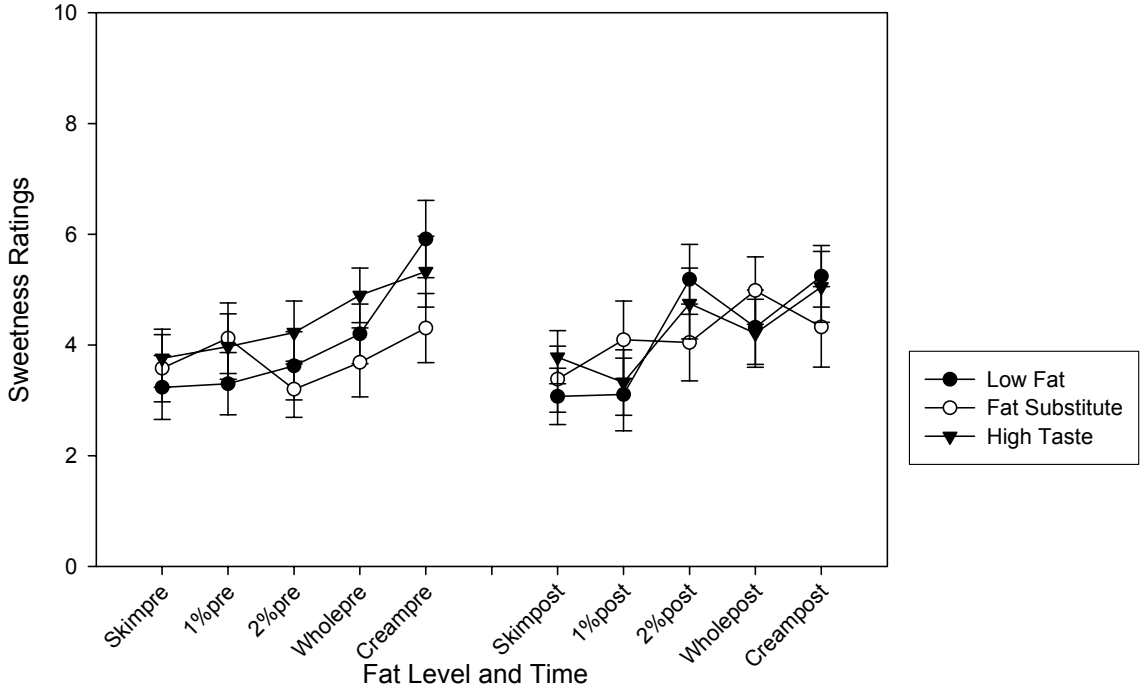


Figure 12.
Milk Likeability Ratings of Groups Over Time

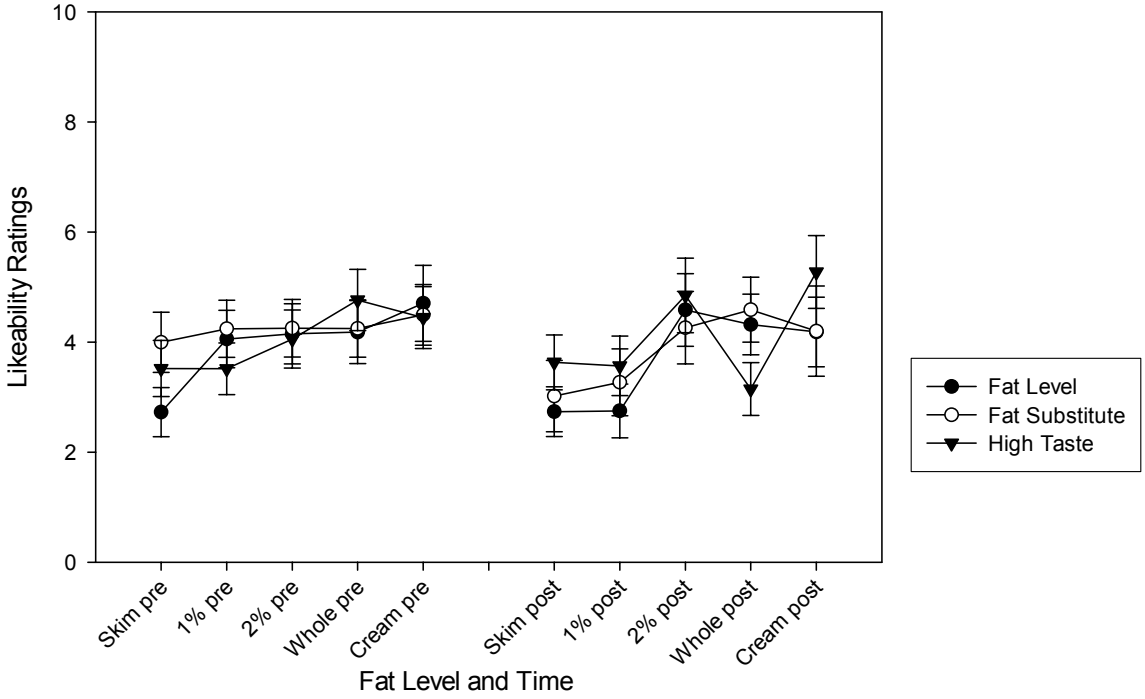
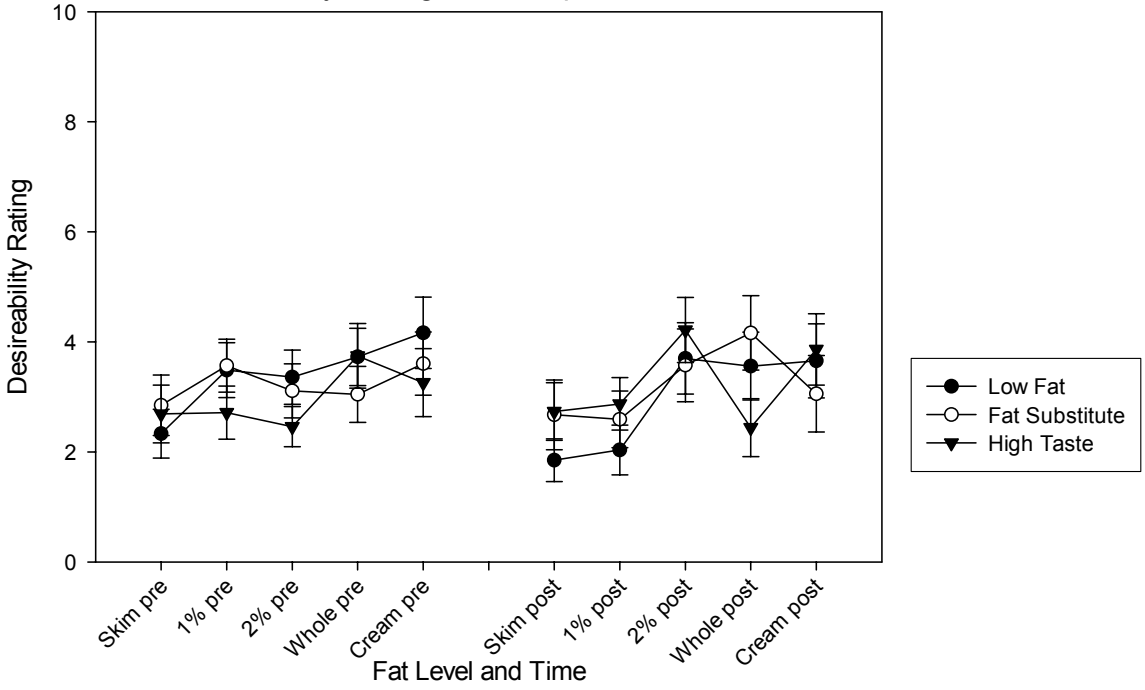


Figure 13.
Milk Desireability Ratings of Groups Over Time



Appendices

A- Phone Screen and Script

B- Demographic Form

C- Medical Information Form

D- Fat Intake Scale

E- Fat Modified Food List

F- Eating Disorders Inventory-Revised

G- Eating Inventory

H- Beck Depression Inventory

I- Taste Rating Sheet

J- Pudding Recipe

K- Newspaper Advertisement

L- Consent Form

M- Psion Handouts

N- Sample 1800 Calorie Menu (LOW FAT)

O- Group Meeting Outline

P- Group Leader Adherence Checklist

Appendix A: Phone Screen and Script

Script for Phone Screen

Hello, my name is _____. I am calling you back regarding the weight loss study. Do you have a few minutes to talk right now?

If no: When can I call you back?

If yes: go on.

I'd like to tell you a few things about the study first and then I'll be glad to answer any questions that you might have in the end, OK? This study is designed to compare three different weight loss programs. We are interested in finding out if changing your diet will change the way certain foods taste to you. We are also interested in understanding factors that influence how easy it is to maintain dietary changes over a 24-week period.

If you are eligible and agree to participate, you will be randomly assigned to a one of three, 6-week weight loss groups. Random assignment is like "flipping a coin" and it means that you will not get to choose which group you will be in. Our groups will meet from 5:15 to 6:15 pm or 7:00 to 8:00 pm on Monday, Wednesday and Thursday evenings. In order to be eligible, you need to be available ALL of these nights initially so we can randomly assign you to one of the groups. Once the groups actually begin, you will only need to come in one night a week, but again you will not be able to choose which night you will be assigned to.

We are located at the Uniformed Services University, which is near the National Naval Medical Center and across the street from NIH in Bethesda, Maryland. All 3 weight loss groups will be run by a senior graduate student who has a M.S. in Medical Psychology and has had 4 years of experience running weight loss groups. Each group involves a mild calorie restriction (1800 calories/day) and focuses on behavioral techniques. No medications or pre-packaged foods will be provided. All group members will receive weekly feedback about their caloric intake and fat intake.

The programs differ in the amount of fat that participants will be asked to eat and in the suggested use of certain fat substitutes. Some groups will be asked to avoid fat substitutes, like low fat salad dressing and low fat margarine, and other groups will be asked to eat them. For six week you will be asked to follow the dietary program of the group that you are assigned to. You will need to get your physicianís permission to participant in the program because we need to know that thereís no risk to you in losing weight. It is unlikely that you will lose more than 3-8 pounds during the six week program, but we hope that the skills you learn during the program will help you after the groups end.

You will be asked to complete some questionnaires and participate in brief taste tests before the groups begin, after the groups end and at 2 follow up points. You will be paid each time you complete these assessment measures. If you complete everything, by the end of the groups you will have had the opportunity to make $60. This helps us to insure that everyone completes the program since we need all of the information requested from you in order to use your data.

Taste Study Phone Screen Form

Date _____ Interviewer _____

1. Are you in the military or a military dependent? YES NO
2. How did you hear about the study? _____
3. Age _____ 4. Sex _____
5. Height _____ inches 6. Weight _____ pounds
7. Have you lost more than 10 pounds in the past month? YES NO
8. Have you lost more than 25 pounds in the past 6 months? YES NO
9. Do you smoke? YES NO
10. Have you been told by a physician that you had:
    - A. Hypertension YES NO
    - B. Heart Disease/Problems YES NO
    - C. High Blood Sugar/Diabetes YES NO
    - D. Thyroid Disease YES NO
    - E. Kidney Disease YES NO
    - F. Major Medical Problems YES NO
11. Are you currently taking any medication? YES NO
    If so, what are you taking? _____
    Why and how much? _____
12. Are you currently pregnant or nursing? YES NO
13. Do you have any food allergies/sensitivities YES NO
    If so, to what? _____
    To milk products? YES NO
    To vanilla pudding? YES NO

IF STILL ELIGIBLE, THEN COMPLETE THE NEXT SECTION

Name _____

Address _____

_____

Home Phone _____ Work Phone _____

Email _____ Fax _____

Appendix B: Demographic Information

19090

DEMOGRAPHIC INFORMATION

Date (DD/MM/YY)

Subject ID

Name (First Last)

Street Address

City State Zip Code

Home Phone

Work Phone

Date of Birth (DD/MMM/YY) Age Weight Height (in inches)

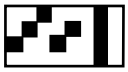
E-mail Address

Ethnicity: Please mark one or more of the following categories to reflect your ethnicity.

1 ☐ American Indian and Alaska Native
2 ☐ Asian
3 ☐ Black or African American
4 ☐ African
5 ☐ Hispanic or Latino
6 ☐ Native Hawaiian or other Pacific Islander
7 ☐ Whites
8 ☐ West Indian or Caribbean

Marital Status

☐ Single, Never Married
☐ Married
☐ Separated
☐ Widowed
☐ Divorced



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Education: Highest degree earned: _____

Highest Grade Completed ___

☐ Some high school
☐ Completed High School/GED
☐ Some College
☐ Completed College
☐ Partial Graduate/Professional School
☐ Completed Graduate School/Professional School

Occupation: _____

Employment Status:

☐ Retired ☐ Homemaker

☐ Full-time ☐ Disabled

☐ Part-time ☐ Unemployed

Annual Household Income:

☐ Below $20,000 ☐ $50,000-$60,000

☐ $20,000-$30,000 ☐ $60,000-$70,000

☐ $30,000-$40,000 ☐ Above $70,000

☐ $40,000-$50,000

Appendix C: Medical Information Form

CODE: _____

MEDICAL INFORMATION FORM

A. Identifying Data:

Name: _____ Home phone: _____

Address: _____ Date of Birth: _____

_____ _____

Occupation: _____ Work phone: _____

Marital Status: Please check the response that applies to you

☐ Single, Never married ☐ Separated
☐ Married ☐ Widowed
☐ Divorced

B. 1. Do you receive regular medical care from a physician or clinic? ☐ No ☐ Yes
If yes, please provide the following information:

Name of physician or clinic_____ phone:_____

2. Have you ever had to be hospitalized? ☐ No ☐ Yes
If yes, please complete the following:

Year	Doctor's Name	Name of Hospital	Reason

3. Have you ever had surgery, or be advised to have surgery? ☐ No ☐ Yes
If yes, please complete following:

Year	Doctor's Name	Name of Hospital	Name of Procedure

No. _____

C. Personal Medical History:

1. Have you ever been told you had any of the following medical conditions?

	NO	YES	When/Explain	If yes, are you currently being treated or followed for these problems
Heart Disease				
High Blood Pressure				
Diabetes or High Blood Sugar				
Cancer				
Thyroid Disease				
Other Hormone Problem				
Alcoholism				
High Cholesterol				
Gall Bladder Problems				
Digestive Disease				
Kidney Disease				
Peptic Ulcers (stomach ulcers)				
Colitis				
Meningitis or Encephalitis				
Tuberculosis				
Stroke				
Rheumatic Fever				
Asthma				
Birth Defects				
Gout				

2 (a) Have you ever had any other disease? ☐No ☐ Yes If yes, explain: _____

_____

_____

3 (b) What is your current weight?_____ lbs. __ estimate __ actual

4 (c) What is the most you have ever weighed?_____lbs. When? _____

5 (d) Have you recently lost or gained any weight? ☐ No ☐ Yes

Can you explain any recent weight loss or gain?_____

_____

Weight gained last month _____ **Weight lost last month** _____

Weight gained last 6 months _____ **Weight lost last six months** _____

Weight gained last year _____ **Weight lost last year** _____

No. _____

6. Have you ever had any injuries?

	No	Yes	When	How did it happen?
Head injury				
Concussion (ever been knocked unconscious				
Food, Chemical, or Drug Poisoning				
Broken Bones				
Severe Cuts or Lacerations				
Other				

7. Do you have my allergies?

	No	Yes	How are you affected?
Hay Fever			
Penicillin			
Medications:			

8. Have you recently had any of the following tests?

	No	Yes	When	Results
Physical Exam				
Blood Tests				
Chest X-ray				
Electrocardiogram (EKG)				
Brain Scan or EMI				
EEG				

9. Are you in the habit of using any of the following?

	Amount Currently Using	Most Ever Used	When Stopped Using
Coffee (cups/day)			
Cigarettes (packs/day)			
Alcohol (amount and types of alcohol used daily)			
Vitamins			
Sleeping Pills			
Aspirin			
Laxatives			
Diet Pills			

No. _____

10. Are you currently on any medication? ☐ No ☐ Yes If yes, please give name and dosage: _____

_____

11. Have you ever used any of the following medications for your mood, nerves, sleep. pain, or energy level?
(Circle the ones used.)

	No	Yes	When/How Long	How Much/Reason
Dilantin, Tegretol, L-Dopa, Cogentin, Artane				
Valium, Librium, Serax, Dalmane. Tranxene, Ativan				
Sinequan, Tofranl, Elavil, Meprobamate				
Lithium				
Thorazine, Mellaril, Stelazine, Navane, Haldol, Prolixin Injection, Loxitane, Moban, Serentil				
Phenobarbital, Seconal, Tuinal, Other barbiturates				
Amphetamines, Ritalin, Other stimulants				
Codeine, Methadone, Percodan, Dilaudid, Taiwin, Darvon, Demeral				
Other				

D. Personal Psychiatric History:

1. Have you ever received any previous psychiatric or psychological evaluation or treatment? ☐ No ☐ Yes If yes, complete the following:

Year	Reason	Medication Used (if any)
_____	_____	_____
_____	_____	_____
_____	_____	_____

2. Have you ever attempted suicide in the past? ☐ No ☐ Yes If yes, complete the following:

Year	How did you attempt suicide?	What happened?
_____	_____	_____
_____	_____	_____
_____	_____	_____

No. _____

E. Review of Your Current Health:

1. Do you have?	No	Yes		No	Yes
Lumps anywhere			Unusual excessive thirst		
Double vision or poor vision			Urine problems, blood in urine		
Difficulty hearing			Indigestion, gas, heartburn		
Fainting spells, blackout spells			Stomach pain or stomach ulcer		
Convulsion			Diarrhea		
Paralysis			Constipation		
Dizziness			Vomiting. vomiting blood		
Headaches			Blood in stool		
Thyroid problem, goiter			Change in appetite or eating habits		
Skin problem			Trouble sleeping		
Cough or wheeze			Sexual problems		
Chest pain			Weight loss or weight gain		
Spitting up blood			Depression		
Shortness of breath at night or with exercise			Problems with memory, thinking, concentration		
Palpitation or heart fluttering			Suicidal thoughts		
Swelling of hands or feet			Weakness or tiredness		
Visual hallucinations			Joint pain		

Please describe or explain any of the positive answers above

_____

_____

_____

2. For Females Only:

Date your last menstrual period began: _____ Number of pregnancies: _____

Number of children born alive: _____ Number of therapeutic abortions: _____

Number of miscarriages or stillbirths: _____ Have you had a Pap smear within the last year? ☐ No ☐ Yes

Do you use any contraceptive method? ☐ No ☐ Yes If yes, what? _____

Do you examine you breast for lumps? ☐ No ☐ Yes

Patient's Signature _____ Date: _____

No. _____

II. TO BE COMPLETED BY PROGRAM PHYSICIAN

In your review of this patient's medical information form, did you encounter any suggestions of an untreated medical problem?

☐ No ☐ Yes If îYesî, specify _____

_____

_____

Physician's Name: _____

(Print First Name, Last Name, Discipline)

Physician's Signature: _____ **Date:** _____

CODE:_____

III. TO BE COMPLETED BY PRIMARY CARE PHYSICIAN

Based on the above medical information form and program description:

☐ Patient should benefit from participation in a mild/(1800 calorie) behavioral weight management program.

☐ Patient should not participate in the weight management program due to the following reasons:

_____

_____

_____

_____

☐ Other (specify):

_____

_____

_____

_____

Physician's Name:_____ (Print First Name, Last Name) Physician's Signature: _____ Date: _____

AUTHORIZATION FOR THE EXCHANGE OF INFORMATION

I hereby authorize Kimberly Kalupa, M.S. At Uniformed Services University, Department of Medical and Clinical Psychology, Weight Management Program and

(Doctor/Agency) _____

Address _____

_____

Phone _____

To share with each other any and all information in their possession acquired in the course of evaluation and/or treatment of _____
(Name of Client)

In addition, I authorize the weight management program to share information with any emergency care givers who are involved in my care in the event of a medical emergency.

You may accept a photocopy of this authorization.

DATE: _____ SIGNED : _____

WITNESS:_____ _____

Client's address: _____

_____

BIRTH DATE: _____ SOCIAL SECURITY: #: _____-_____-_____

Appendix D: Fat Intake Scale

NWLRC Fat Intake Scale

Check the answer which best describes the way you have been eating over the past month.

1. **How many ounces of meat, fish or poultry do you usually eat?***

   ___ 1. I do not eat meat, fish or poultry.
   ___ 2. I eat 3 ounces or less per day.
   ___ 3. I eat 4-6 ounces per day.
   ___ 4. I eat 7 or more ounces per day.

   *3 ounces of meat, fish or chicken is any **ONE** of the following: 1 regular hamburger, 1 chicken breast, 1 chicken leg (thigh and drumstick), 1 pork chop or 3 slices of pre-sliced lunch meat.

2. **How much cheese do you eat per week?**

   ___ 1. I do not eat cheese.
   ___ 2. I eat whole milk cheese less than once a week and/or use only low fat cheese such as diet cheese, low fat cottage cheese, or ricotta.
   ___ 3. I eat whole milk cheese once or twice per week (such as cheddar, swiss, monterey jack).
   ___ 4. I eat whole milk cheese three or more times per week.

3. **What type of milk do you use?**

   ___ 1. I use only skim or 1% milk. or don't use milk.
   ___ 2. I usually use skim milk or 1% milk, but use others occasionally.
   ___ 3. I usually use 2% or whole milk.

4. **How many visible egg yolks do yon use per week?**

   ___ 1. I avoid all egg yolks or use less than one per week and/or use only egg substitute.
   ___ 2. I eat 1-2 egg yolks per week.
   ___ 3. I eat 3 or more egg yolks per week.

5. **How often do you eat these meats: regular hamburger, bologna, salami, hot dogs, corned beef, spareribs, sausage, bacon, braunsweiger, or liver? Do not count others.**

   ___ 1. I do not eat any of these meats.
   ___ 2. I eat them about once per week or less.
   ___ 3. I eat them about 2 to 4 times per week.
   ___ 4. I eat more than 4 servings per week.

6. **How many commercial baked goods and how much regular ice cream do you usually eat? (Examples: cake, cookies, coffee cake, sweet rolls, donuts, etc. Do not count low fat versions.)**

   ___ 1. I do not eat commercial baked goods and ice cream.
   ___ 2. I eat commercial baked goods or ice cream once per week or less.
   ___ 3. I eat commercial baked goods or ice cream 2 to 4 times per week.
   ___ 4. I eat commercial baked goods or ice cream more than 4 times per week.

7. What is the main type of fat you cook with?

___ 1. I use nonstick spray or I do not use fat in cooking.
___ 2. I use a liquid oil (Examples: safflower, sunflower, corn, soybean, and olive oil.)
___ 3. I use margarine.
___ 4. I use butter, shortening, bacon drippings, or lard.

8. How often do you eat snack foods such as chips, fries or party crackers?

___ 1. I do not eat these snack foods.
___ 2. I eat one serving of these snacks per week.
___ 3. I eat these snacks 2 to 4 times per week.
___ 4. I eat these snack foods more than four times per week.

9. What spread do you usually use on bread, vegetables, etc?

___ 1. I do not use any spread.
___ 2. I use diet or light margarine.
___ 3. I use margarine
___ 4. I use butter.

10. How often do you eat as a snack candy bars, chocolate, or nuts?

___ 1. Less than once per week.
___ 2. One to 3 times per week.
___ 3. More than 3 times per week.

11. When you use recipes or convenience foods, how often are they low fat?

___ 1. Almost always.
___ 2. Usually.
___ 3. Sometimes.
___ 4. Seldom or never.

12. When you eat away from home, how often do you choose low fat foods?

___ 1. Almost always.
___ 2. Usually.
___ 3. Sometimes.
___ 4. Seldom or never.

To Score: Add the points for each answer. If you have 24 or less, your diet is moderate to low in fat and cholesterol. If your score is greater than 24, look for high fat choices you could change.

Northwest Lipid Research Clinic **depts.washington.edu/nwlrc**
University of Washington **www.washingtoington.edu**
325 Ninth Avenue, Box 359720
Seattle, WA 98104
Tele 206/341-4404; e-mail retz@u.washington.edu

Appendix E: Fat Modified Food List

Fat Modified Food List

Please complete a fat modified food list for each day. List the amount of the product that you used for each day every week. If you use the product more than once, fill out a separate row.

PRODUCT	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Light Butter							
Light Margarine							
Light Spread							
Light Mayonnaise							
Reduced fat salad dressing							
Light cream cheese							

CODE _____

DATE _____

Fat free cream cheese							
Reduced fat cheese							
Low fat hot							
Low fat cracker							
Low fat cookie							
Fat free soup							
Other							
Other							
Other							
Other							
Other							
Other							

Appendix F: Eating Disorders Inventory

19214

EDI

For each item, decide if the item is true about you ALWAYS, USUALLY, OFTEN, SOMETIMES, RARELY, or NEVER. Check the box that corresponds to your rating. Respond to all of the items, making sure that you circle the letter for the rating that is true about you.

	Always	Usually	Often	Sometimes	Rarely	Never
1. I eat sweets and carbohydrates without feeling nervous.	☐	☐	☐	☐	☐	☐
2. I think that my stomach is too big.	☐	☐	☐	☐	☐	☐
3. I wish that I could return to the security of childhood.	☐	☐	☐	☐	☐	☐
4. I eat when I am upset.	☐	☐	☐	☐	☐	☐
5. I stuff myself with food.	☐	☐	☐	☐	☐	☐
6. I wish that I could be younger.	☐	☐	☐	☐	☐	☐
7. I think about dieting.	☐	☐	☐	☐	☐	☐
8. I get frightened when my feelings are too strong.	☐	☐	☐	☐	☐	☐
9. I think that my thighs are too large.	☐	☐	☐	☐	☐	☐
10. I feel ineffective as a person.	☐	☐	☐	☐	☐	☐
11. I feel extremely guilty after overeating.	☐	☐	☐	☐	☐	☐
12. I think that my stomach is just the right size.	☐	☐	☐	☐	☐	☐
13. Only outstanding performance is good enough in my family.	☐	☐	☐	☐	☐	☐
14. The happiest time in life is when you are a child.	☐	☐	☐	☐	☐	☐
15. I am open about my feelings.	☐	☐	☐	☐	☐	☐
16. I am terrified of gaining weight.	☐	☐	☐	☐	☐	☐
17. I trust others.	☐	☐	☐	☐	☐	☐
18. I feel alone in the world.	☐	☐	☐	☐	☐	☐
19. I feel satisfied with the shape of my body.	☐	☐	☐	☐	☐	☐
20. I feel generally in control of things in my life.	☐	☐	☐	☐	☐	☐
21. I get confused about what emotion I am feeling.	☐	☐	☐	☐	☐	☐
22. I would rather be an adult than a child.	☐	☐	☐	☐	☐	☐
23. I can communicate with others easily.	☐	☐	☐	☐	☐	☐
24. I wish I were someone else.	☐	☐	☐	☐	☐	☐
25. I exaggerate or magnify the importance of my weight.	☐	☐	☐	☐	☐	☐
26. I can clearly identify what emotion I am feeling.	☐	☐	☐	☐	☐	☐
27. I feel inadequate.	☐	☐	☐	☐	☐	☐
28. I have gone on eating binges where I felt that I could not stop.	☐	☐	☐	☐	☐	☐
29. As a child, I tried very hard to avoid disappointing my parents and teachers.	☐	☐	☐	☐	☐	☐
30. I have close relationships.	☐	☐	☐	☐	☐	☐
31. I like the shape of my buttocks.	☐	☐	☐	☐	☐	☐
32. I am preoccupied with the desire to be thinner.	☐	☐	☐	☐	☐	☐


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	Always	Usually	Often	Sometimes	Rarely	Never
33. I don't know what's going on inside me.	☐	☐	☐	☐	☐	☐
34. I have trouble expressing my emotions to others.	☐	☐	☐	☐	☐	☐
35. The demands of adulthood are too great.	☐	☐	☐	☐	☐	☐
36. I hate being less than the best at things.	☐	☐	☐	☐	☐	☐
37. I feel secure about myself.	☐	☐	☐	☐	☐	☐
38. I think about bingeing (overeating).	☐	☐	☐	☐	☐	☐
39. I feel happy that I am not a child anymore.	☐	☐	☐	☐	☐	☐
40. I get confused as to whether or not I am hungry.	☐	☐	☐	☐	☐	☐
41. I have a low opinion of myself.	☐	☐	☐	☐	☐	☐
42. I feel that I can achieve my standards.	☐	☐	☐	☐	☐	☐
43. My parents have expected excellence of me.	☐	☐	☐	☐	☐	☐
44. I worry that my feelings will get out of control.	☐	☐	☐	☐	☐	☐
45. I think that my hips are too big.	☐	☐	☐	☐	☐	☐
46. I eat moderately in front of others and stuff myself when they're gone.	☐	☐	☐	☐	☐	☐
47. I feel bloated after eating a normal meal.	☐	☐	☐	☐	☐	☐
48. I feel that people are the happiest when they are children.	☐	☐	☐	☐	☐	☐
49. If I gain a pound, I worry that I will keep gaining.	☐	☐	☐	☐	☐	☐
50. I feel that I am a worthwhile person.	☐	☐	☐	☐	☐	☐
51. When I am upset, I don't know if I am sad or frightened.	☐	☐	☐	☐	☐	☐
52. I feel that I must do things perfectly or not do them at all.	☐	☐	☐	☐	☐	☐
53. I have the thought of trying to vomit in order to lose weight.	☐	☐	☐	☐	☐	☐
54. I need to keep people at a certain distance (feel uncomfortable if someone tries to get too close).	☐	☐	☐	☐	☐	☐
55. I think that my thighs are just the right size.	☐	☐	☐	☐	☐	☐
56. I feel empty inside (emotionally).	☐	☐	☐	☐	☐	☐
57. I can talk about personal thoughts or feelings.	☐	☐	☐	☐	☐	☐
58. The best years of your life are when you become an adult.	☐	☐	☐	☐	☐	☐
59. I think my buttocks are too large.	☐	☐	☐	☐	☐	☐
60. I have feelings I can't quite identify.	☐	☐	☐	☐	☐	☐
61. I eat or drink in secrecy.	☐	☐	☐	☐	☐	☐
62. I think that my hips are just the right size.	☐	☐	☐	☐	☐	☐
63. I have extremely high goals.	☐	☐	☐	☐	☐	☐
64. When I am upset, I worry that I will start eating.	☐	☐	☐	☐	☐	☐

Appendix G: Eating Inventory

19090

EI

DIRECTIONS: Please answer the following questions by circling true or false.

1. When I smell a sizzling steak or see a juicy piece of meat, I find it very difficult to keep from eating, even if I have just finished a meal. ☐ True ☐ False

2. I usually eat too much at social occasions, like parties and picnics. ☐ True ☐ False

3. I am usually so hungry that I eat more than three times a day. ☐ True ☐ False

4. When I have eaten my quota of calories, I am usually good about not eating any more. ☐ True ☐ False

5. Dieting is so hard for me because I just get too hungry. ☐ True ☐ False

6. I deliberately take small helpings as a means of controlling my weight. ☐ True ☐ False

7. Sometimes things just taste so good that I keep on eating even when I am no longer hungry. ☐ True ☐ False

8. Since I am often hugry, I sometimes wish that while I am eating, an expert would tell me that I have had enough or that I can have something more to eat. ☐ True ☐ False

9. When I feel anxious, I find myself eating. ☐ True ☐ False

10. Life is too short to worry about dieting. ☐ True ☐ False

11. Since my weight goes up and down, I have gone on reducing diets more than once. ☐ True ☐ False

12. I often feel so hungry that I just have to eat something. ☐ True ☐ False

13. When I am with someone who is overeating, I usually overeat too. ☐ True ☐ False

14. I have a pretty good idea of the number of calories in common food. ☐ True ☐ False

15. Sometimes when I start eating, I just can't seem to stop. ☐ True ☐ False

16. It is not difficult for me to leave something on my plate. ☐ True ☐ False

17. At certain times of the day, I get hungry because I have gotten used to eating then. ☐ True ☐ False

18. While on a diet, if I eat food that is not allowed, I consciously eat less for a period of time to make up for it. ☐ True ☐ False

19. Being with someone who is eating often makes me hungry enough to eat also. ☐ True ☐ False

20. When I feel blue, I often overeat. ☐ True ☐ False

21. I enjoy eating too much to spoil it by counting calories or watching my weight. ☐ True ☐ False

22. When I see a real delicacy, I often get so hungry that I have to eat right away. ☐ True ☐ False

23. I often stop eating when I am not really full as a conscious means of limiting the amount that I eat. ☐ True ☐ False

24. I get so hungry that my stomach often seems like a bottomless pit. ☐ True ☐ False

25. My weight has hardly changed at all in the last ten years. ☐ True ☐ False

26. I am always hungry so it is hard for me to stop eating beore I finish the food on my plate. ☐ True ☐ False

27. When I feel lonely, I console myself by eating. ☐ True ☐ False

28. I consciously hold back at meals in order not to gain weight. ☐ True ☐ False

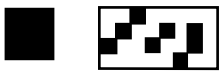
29. I sometimes get very hungry late in the evening or at night. ☐ True ☐ False

30. I eat anything I want, any time I want. ☐ True ☐ False

31. Without even thinking about it, I take a long time to eat. ☐ True ☐ False

32. I count calories as a conscious means of controlling my weight. ☐ True ☐ False

33. I do not eat some foods because they make me fat. ☐ True ☐ False



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34. I am always hungry enough to eat at any time. ☐ True ☐ False

35. I pay a great deal of attention to changes in my figure. ☐ True ☐ False

36. While on a diet, if I eat a food that is not allowed, I often then splurge and eat other high calorie foods. ☐ True ☐ False

Part II

DIRECTIONS: Please answer the following questions by putting an "x" in the box above the response that is most appropriate to you.

37. How often are you dieting in a conscious effort to control your weight?

☐	☐	☐	☐
1	2	3	4
rarely	sometimes	usually	always

38. Would a weight fluctuation of 5 lbs. affect the way you live your life?

☐	☐	☐	☐
1	2	3	4
not at all	slightly	moderately	very much

39. How often do you feel hungry?

☐	☐	☐	☐
1	2	3	4
only at mealtimes	sometimes between meals	often between meals	almost always

40. Do your feelings of guilt about overeating help you to control your food intake?

☐	☐	☐	☐
1	2	3	4
never	rarely	often	always

41. How difficult would it be for you to stop eating halfway through dinner and not eat for the next four hours?

☐	☐	☐	☐
1	2	3	4
easy	slightly difficult	moderately difficult	very difficult

42. How conscious are you of what you are eating?

☐	☐	☐	☐
1	2	3	4
not at all	slightly	moderately	extremely

43. How frequently do you avoid 'stocking up' on tempting foods"

☐	☐	☐	☐
1	2	3	4
almost never	seldom	usually	almost always

44. How likely are you to shop for low calorie foods?

☐	☐	☐	☐
1	2	3	4
unlikely	slightly likely	moderately likely	very likely

45. Do you ever eat sensibly in front of others and splurge alone?

☐	☐	☐	☐
1	2	3	4
never	rarely	often	always

46. How likely are you to consciously eat slowly in order to cut down on how much you eat?

☐	☐	☐	☐
1	2	3	4
unlikely	sliightly likely	moderately likely	very likely

47. how frequently do you skip dessert because you are no longer hungry?

☐ 1	☐ 2	☐ 3	☐ 4
almost never	seldom a week	at least once a day	almost every day

48. How likely are you to consciously eat less than you want?

☐ 1	☐ 2	☐ 3	☐ 4
unlikely	slightly likely	moderately likely	very likely

49. Do you go on eating binges though you are not hungry?

☐ 1	☐ 2	☐ 3	☐ 4
never	rarely	at least once a day	very likely

50. On a scale of 0 to 5, where 0 means no restraint in eating (eating whatever you want) and 5 means total restraint (constantly limiting food intake and never "giving in"), what number would you give yourself?

☐ 0--eat whatever you want, whenever you want it

☐ 1--usually eat whatever you want, whenever you want it

☐ 2--often eat whatever you want, whenever you want it

☐ 3-- often limit food in take, but often "give in"

☐ 4--usuaIly limit food intake, rarely "give in"

☐ 5--constantly limiting food intake, never "giving in"

51. To what extent does this statement describe your eating behavior? "I start dieting in the morning but because of any number of things that happen during the day, by evening I have given up and eat what I want, promising myself to start dieting again tomorrow."

☐ 1	☐ 2	☐ 3	☐ 4
not like me	little like me	pretty good description of me	describes me perfectly

Appendix H: Beck Depression Inventory

19214

BDI-II

☐ Pre ☐ Post ☐ 6 week ☐ 18 week

Subject ID

Instructions: This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today.** Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statment for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness

☐ I do not feel sad.

☐ I feel sad much of the time.

☐ I feel sad all time.

☐ I am so sad or unhappy that I can't stand it.

2. Pessimism

☐ I am not discouraged about my future.

☐ I feel more discouraged about my future than I used to be.

☐ I do not expect things to work out for me.

☐ I feel my future is hopeless and will only get worse.

3. Past Failure

☐ I do not feel like a failure.

☐ I have failed more than I should have.

☐ As I look back, I see a lot of failures.

☐ I feel I am a total failure as a person.

4. Loss of Pleasure

☐ I get as much pleasure as I ever did from the things I enjoy.

☐ I don't enjoy things as much as I used to.

☐ I get very little pleasure from the things I used to enjoy.

☐ I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings

☐ I don't feel particularly guilty.

☐ I feel guilty over many things I have done or should have done.

☐ I feel guilty all of the time.

6. Punishment

☐ I don't feel I am being punished.

☐ I feel I may be punished.

☐ I expect to be punished.

☐ I feel I am being punished.

7. Self-Dislike

☐ I feel the same about myself as ever.

☐ I have lost confidence in myself.

☐ I am disappointed in myself.

☐ I dislike myself.

8. Self-Criticalness

☐ I don't criticize or blame myself more than usual.

☐ I am more critical of myself than I used to be.

☐ I criticize myself for all of my faults.

☐ I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes

☐ I don't have any thoughts of killing myself.

☐ I have thoughts of killing myself, but I would not carry them out.

☐ I would like to kill myself.

☐ I would kill myself if I had the chance.

10. Crying

☐ I don't cry anymore than I used to.

☐ I cry more than I used to.

☐ I cry over every little thing.

☐ I feel I am being punished.

19214

11. Agitation

- ☐ I am no more restless or wound up than usual.
- ☐ I feel more restless or wound up than usual.
- ☐ I am so restless or agitated that it's hard to stay still.
- ☐ I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

- ☐ I have not lost interstt in other people or activities.
- ☐ I am less interested in other people or things than before.
- ☐ I have lost most of my interest in other people or things.
- ☐ It's hard to get interested in anything.

13. Indecisiveness

- ☐ I make decisions about as well as ever.
- ☐ I find it more difficult to make decisions than usual.
- ☐ I have lost most of my interest in other people or things.
- ☐ It's hard to get interested in anything.

14. Worthlessness

- ☐ I do not feel I am worthless.
- ☐ I don't consider myself as worthwhile and useful as I used to.
- ☐ I feel more worthless as compared to other people.
- ☐ I feel utterly worthless.

15. Loss of Energy

- ☐ I have as much energy as ever.
- ☐ I have less energy than I used to have.
- ☐ I don't have enough energy to do very much.
- ☐ I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

- ☐ I have not experienced any change in my sleeping pattern.
- ☐ I sleep somewhat more than usual.
- ☐ I sleep somewhat less than usual.
- ☐ I sleep a lot more than usual.
- ☐ I sleep a lot less than usual.
- ☐ I sleep most of the day.
- ☐ I wake up 1-2 hours early and can't get back to sleep.

17. Irritability

- ☐ I am no more irritable than usual.
- ☐ I am more irritable than usual.
- ☐ I am much more irritable than usual.
- ☐ I am irritable all the time.

18. Changes in Appetite

- ☐ I have not experienced any change in my appetite.
- ☐ My appetite is somewhat less than usual.
- ☐ My appetite is somewhat greater than usual.
- ☐ My appetite is much less than before.
- ☐ My appetite is much greater than usual.
- ☐ I have no appetite at all.
- ☐ I crave food all the time.

19. Concentration Difficulty

- ☐ I can concentrate as well as ever.
- ☐ I can't concentrate as well as usual.
- ☐ It's hard to keep my mind on anything for very long.
- ☐ I find I can't concentrate on anything.

20. Tiredness or Fatigue

- ☐ I am no more tired or fatigued than usual.
- ☐ I get more tired or fatigued more easily than usual.
- ☐ I am too tired or fatigued to do a lot of things I used to do.
- ☐ I am too tired or fatigued to do most of the things that I used to do.

21. Loss of Interest in Sex

- ☐ I have not noticed any recent change in my interest in sex.
- ☐ I am less interested in sex than I used to be.
- ☐ I am much less interested in sex now.
- ☐ I have lost interest in sex completely.

Appendix I: Taste Rating Sheet

Pudding Rating Sheet

CODE _____
Sample#_____
Date _____

Instructions: Taste the pudding sample and complete the ratings below. When you have completed your ratings, turn to the next rating sheet in this booklet, and then ask the Leader for your next sample.

How SWEET is this pudding ?
Not at all _____ Extremely

How CREAMY is this pudding ?
Not at all _____ Extremely

How FLAVORFUL is this pudding ?
Not at all _____ Extremely

How much do you ***LIKE*** this pudding ?
Not at all _____ Extremely

If you could eat more of this pudding, how much do you think you would eat ?
None _____ A lot

Do you have any comments about this pudding sample? If so, write them in the space below

Appendix J: Pudding Recipe

Pudding Recipe

Ingredients : 90 grams Jell-O brand instant dry vanilla pudding mix

500 grams milk (skim, 1%, 2%, whole, or half and half)

Method: Pour some of the milk in a blender, add pudding mix, then add the rest of the half-and half. Add .8 ml of McCormick yellow food coloring to pudding made with whole milk or half and half. Blend at the lowest speed for 20 seconds. Pour into 30-ml cups and refrigerate.

Appendix K: Newspaper Advertisement

BRIEF WEIGHT MANAGEMENT PROGRAM

Uniformed Services University in Bethesda is looking for otherwise healthy, overweight women between the ages of 18-60, who are not pregnant or nursing, to participate in an ongoing study examining the impact of different diets on taste perception. Applicants should not smoke, have food allergies to milk or pudding, or have problems with thyroid, kidney, heart disease, diabetes, or uncontrolled hypertension. Program and materials provided at no cost. Interested individuals please call (301) 295-9666.

Appendix L: Consent Form

UNIFORMED SERVICES UNIVERSITY OF THE HEALTH SCIENCES
4301 JONES BRIDGE ROAD
BETHESDA, MARYLAND 20814-4799

Consent for Participation in a Research Study

Title of Project: The impact of a low fat diet and fat-modified food on taste during weight loss.
Principal Investigator: Kimberly Kalupa, M.S.

TO PERSONS WHO AGREE TO PARTICIPATE IN THIS STUDY:

The following information is provided to inform you about the research project and your participation in it. Please read this form carefully and feel free to ask any questions you may have about this study and/or about the information given below.

It is important that you understand that your participation in this study is totally voluntary. **You may refuse to participate or choose to withdraw from this study at any time.** If, during the course of the study, you should have any questions about the study, your participation in it, or about your rights as a research subject, you may contact:

Kimberly Kalupa, M.S. at (301) 295-9664 or
Tracy Sbrocco, Ph.D. at (301) 295-9674
Department of Medical and Clinical Psychology, USUHS, Bethesda, MD 20814-4799

1. INDICATED BELOW ARE THE FOLLOWING:
   a. THE PURPOSE OF THIS STUDY
   b. THE PROCEDURES TO BE FOLLOWED
   c. THE APPROXIMATE DURATION OF THE STUDY

1a. THE PURPOSE OF THIS STUDY:

Overweight and obesity are the second leading cause of preventable death in the United States and are on the rise. Many of the risks associated with overweight and obesity can be reduced if small to moderate (10% of body weight) weight loss is achieved. Traditionally, weight loss programs recommend dietary changes including eating fewer calories and changing the kinds of food that people eat. Low fat diets have been recommended as a way for people to lose and maintain body weight without "depriving" themselves. But, reducing fat in a diet can cause major changes in a diet's flavor. These changes in a diet's flavor may make it difficult for people to follow a low fat diet for a long time.

Most weight reduction programs suggest decreasing the overall percentage of dietary fat to less than 30% of the total caloric intake. However, sticking to a low fat diet is difficult. This may be because most people enjoy the taste of fat. Some people might be more likely to lose weight if they learn to smaller portions of the foods that they like. The average American consumes 36% of their calories in fat. This is true for people who

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Participants Initials_____Date_____ Witness initials_____Da..._____

are normal weight and for people who are overweight. One difference between normal weight and overweight people is the amount of foods that are eaten.

There are two purposes of the present study. One purpose is to see what happens to taste perception when women make changes to their diet. The other purpose is to examine factors that influence women's ability to stick to a mild calorie restriction (1800 calorie) diet. Three different diets will be compared to see how the different diets effect how much certain foods are liked.

Diet #1 is like the typical American diet with approximately 36% of the calories coming from fat. Women in diet #1 will be asked to cut back on the amount of food that they are eating, without seriously changing the makeup of their diet.

Diet #2 will focus on cutting back on dietary fat to 20-25% of total calories, while reducing calories to 1800. Women in diet #2 will be asked not to use fat substitutes like low fat sour cream or low fat salad dressing.

Diet # 3 is also a low fat diet, with 20-25% if the calories coming from fat. Individuals in this group will be encouraged to use fat substitutes, like low fat mayonnaise and low fat cream cheese. Similar to the other groups, calories will be reduced to 1800.

In summary, each group is set up to see what happens to taste perception after being on a modified diet and to figure out what helps people stick to an 1800 calorie diet plan.

1b. THE PROCEDURES TO BE FOLLOWED:

Individuals within a certain weight range, and having at least 30% of their calories coming from fat, and meeting other criteria are being asked to participate in a weight management study that looks at changes in taste while dieting. In addition, the impact of different tasting diets on a people's ability to stay on the diet plan will be examined. The study will include three phases. During the first phase, we will be collecting information on your health, feelings, taste ratings, and eating habits. This phase will take approximately one week to complete and people completing this phase, with their physician's permission, will be asked to participate in the second phase. The second phase involves participation in a 6-week weight management program. The third phase involves follow up meetings (at 6 weeks and 18 weeks) to see how things are going several months after the weight loss groups end.

Phase 1- Initial information collection

At this first visit, we will be asking you to fill out some questionnaires that will provide us information on your lifestyle, background and medical history. You must obtain permission from your primary care physician to participate in the weight management program. We will ask you to sign a release of information so we may inform your physician about the program and communicate with your physician regarding your physical status. We will send a copy of the medical screen you complete today, a program overview and a permission form to your physician. You may NOT participate without your physician's permission. Next you will be instructed on keeping

an eating diary. We will ask you to keep this diary for one week. To qualify for participation in this study, you must return in one week with a completed diary.

At this return visit, you will be asked to complete questionnaires that give us information about your eating habits, attitudes toward eating, and information about how you feel about yourself in general. If from these questionnaires you appear depressed, or if we are concerned that you might hurt yourself, we will provide appropriate referrals for you in the community. After completing the questionnaires, you will also be asked to complete a series of taste tests and to rate the taste of 5 samples of milk and five samples of vanilla pudding. The taste tests will last approximately 10 minutes. You will receive $10 for completing all measures. When you have completed the taste test and the questionnaires, turned in a complete diary, and obtained your physicianís permission, you will be offered participation in one of the weight loss groups.

Phase 2- Weight Management

You will be **randomly assigned** to one of three mild dietary restriction (approximately 1800 calories a day) groups. Random assignment is like ìflipping a coinî and means that you do not get to pick your group. Most people who enter the study will be eating from 2300-2700 calories a day. These diets are described in more detail on page 2 of the consent form and are summarized here.

1. Diet #1
   Individuals will eat 1800 calories with 36% of their calories coming from fat.

2. Diet #2
   Individuals will eat 1800 calories and will reduce their fat intake to 20-25% of their total calories. In this group, fat substitutes will NOT be used.

3. Diet #3
   Individuals will eat 1800 calories, with 20-25% of their calories coming from fat, but will be encouraged to use certain fat substitutes.

All groups will be made up of 10-15 people and will be led by Kimberly Kalupa, M.S., a graduate student in Medical Psychology. The group will meet once a week for six weeks. Group meetings will last 60 minutes and will be used to teach you new information about nutrition, weight loss and eating habits, to give you feedback on your eating habits and to help you begin to change your behavior. You will be asked to keep a computerized eating diary throughout the program and you will be asked to complete weekly activity logs so that we can monitor your exercise. You will be weighed weekly. Each group will be audiotaped and reviewed by a research assistant to insure that all groups are receiving comparable treatment from the group leader. After each tape is reviewed, they will be erased. You will be paid $20 if you complete the 6-week program.

Immediately after finishing the 6-week weight loss program, you will be asked to complete the same assessments you completed at the beginning of the study, including the questionnaires and taste tests. You will receive an additional $10 for completing all measures at post treatment.

Phase 3- Follow Up

One of the hardest things about weight loss is sticking to a diet. You will be asked to return 6 weeks and 18 weeks after the end of your weight loss treatment for follow up visits with your other group members. During these visits, we will check in with you to help you stay on track with regard to your weight loss program. You will be asked to remember everything that you ate over the previous 24-hours. You will also be weighed, and asked to complete another taste test. The follow up session will be used to look at your weight loss progress and to help you develop a plan for eating.

1c. DURATION OF THE STUDY

The study will involve 6 weeks of intensive participation. Phase 1 will last 2 weeks. Phase 2 will last 6 weeks. Phase 3 will last 18 weeks, but involves minimal active participation.

SUMMARY OF RESEARCH PLAN

Pretreatment	Orientation I & II
Treatment	6 one-hour sessions
Follow up	2 one-hour sessions (6 & 18 weeks)

2. THE STUDY IS BEING DONE SOLELY FOR THE PURPOSES OF RESEARCH.

3. DISCOMFORTS, INCONVENIENCES AND/OR RISKS THAT CAN BE REASONABLY EXPECTED ARE:

a. Before you can participate in the study, you will be asked to get permission from your personal physician. If your physician requires you to get a physical, you will NOT be reimbursed by the researchers. You may find the time and money required to get a physical to be inconvenient. If you do not have a personal physician or are unable to afford a physical, the researchers will attempt to help you find lower-cost referrals in the greater Washington D.C. area. If you require a referral and/or a physical, you may not be able to begin the study as soon as you would like to.

b. The risks associated with this study are minor. You may find that the questionnaires may make you feel uncomfortable. You may refuse to answer any question that you are uncomfortable with. You will NOT be forced to do anything you do not want to do. You may decline to participate at any time and/or withdraw your participation at any time.

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c. The study involves a time commitment that you may find inconvenient. You will be asked to meet weekly for 6 weeks, keep an eating diary, and come to the university for several appointments. You will also be asked to return to the university twice during the 18 week follow up.

4. POSSIBLE BENEFITS TO YOU THAT MAY BE REASONABLY EXPECTED ARE:

a. You may participate in a 6-week weight management program that may help you gain a better understanding of your eating behavior and may help you manage your weight. You may learn about yourself and your relationship to food. The testing is conducted at no charge. You will be paid $10 for completing the baseline measures, $20 for completing the weight loss program, and an additional $10 for post-treatment.

5. THE BENEFITS TO SCIENCE AND TO HUMANKIND THAT ARE SOUGHT IN THIS STUDY ARE:

You will be providing information that will be helpful in expanding scientific knowledge about eating behavior. The results of this study will help us gain a better understanding of how diet composition and the use of fat substitutes impact taste perception and eating behavior.

6. ALTERNATE PROCEDURES THAT MAY BE ADVANTAGEOUS:

There are many commercial programs available for weight loss. The behavioral program is similar in many ways to commercial programs, except it is shorter and offered at no cost. It most likely offers more sophisticated and comprehensive assessment techniques.

7. CONFIDENTIALITY: YOUR RIGHTS, WELFARE, AND PRIVACY WILL BE PROTECTED IN THE FOLLOWING MANNER:

Only properly authorized persons such as those directly concerned with the study including the principal investigator, project assistants, regulatory authorities, and persons on the Institutional Review Board will be allowed access to your records. Any information will be treated as strictly confidential in accordance with applicable laws and regulations, and will not be made publicly available. By signing the consent form attached, you are authorizing such access to your records. All information collected during the study will be kept confidential. If any information is published, your identity will not be revealed and will be referred to by number. Because information may be revealed during the group sessions, all group members will be informed that group membersí names and personal information discussed in group is confidential and should not be discussed outside of the group. In addition, you will be asked to sign a release of information form so that we can communicate with your physician should you develop any health related concerns during the study.

Participant Initials_____Date_____ Witness Initials_____Date_____

Note: YOU ARE FREE TO WITHDRAW THIS CONSENT AND TO STOP PARTICIPATING IN THIS STUDY OR ANY ACTIVITY AT ANY TIME FOR ANY REASON.

8. RECOURSE IN THE EVENT OF INJURY

In the event of a medical emergency while participating in this study, you will receive emergency treatment in the facility you are in or a nearby Department of Defense (military) medical facility (hospital or clinic). Emergency treatment/care will be provided even if you are not eligible to receive such care at a military facility. We will not provide care for any preexisting conditions. When deemed appropriate, emergency care will be continued until the medical doctor treating you decides that you are out of immediate danger. If you are not entitled to care in a military facility, you may be transferred to a private civilian hospital. The attending doctor or member of the hospital staff will go over the transfer decision with you before it happens. The military will bill your health insurance for health care you receive which is not part of the study. If you are uninsured, you will not be personally billed for such care, and you WILL NOT be expected to pay for medical care at military hospitals.

In case you need additional care following discharge from the military hospital or clinic, a military health care professional will decide whether your need for care is directly related to being in this study. If your need for care is related to the study, the military may offer you limited health care at its military facilities.

If you believe the government or one of the government's employees (such as a military doctor) has injured you, a claim for damages (money) against the federal government (including the military) may be filed under the Federal Tort Claims Act. If you would like to file a claim, please contact the University's Office of General Counsel and request the filing forms.

If at any time you believe that you have suffered an injury or illness as a result of participating in this research project, you should contact the Office of Research at the Uniformed Services University of the Health Sciences, Bethesda, Maryland 20814 at (301) 295-3303. This office can review the matter with you, provide information about your rights as a subject, and may be able to identify resources available to you. Information about judicial avenues of compensation is available from the Universityís General Counsel at (301) 295-3028.

Should you have any questions at any time about the study or about your rights, you may contact Kimberly Kalupa, M.S., Department of Medical & Clinical Psychology, USUHS, Bethesda, MD 20814-4799, (301)295 9664.

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Participant Initials_____Date_____ Witness Initials_____Date_____

STATEMENT BY PERSONS AGREEING TO PARTICIPATE IN THIS RESEARCH PROJECT:

I have read this consent form and I understand the procedures to be used in this study and the possible risks, inconveniences, and/or discomforts that may be involved. All of my questions have been answered. I freely and voluntarily choose to participate. I understand I may withdraw at any time. My signature also indicates that I have received a copy of the consent form for my information.

SIGNATURES

_____	_____
Signature of Witness	Signature of Volunteer
_____	_____
Witness Name (Printed)	Volunteer Name (Printed)
Date_____	Date_____

I certify that I or my research staff have explained the research study to be above individual and that the individual understands the nature and purpose, the possible risks and benefits associated in taking part in this research study. Any questions that have been raised, have been answered.

Investigator's or
Designee's Signature _____

Printed Name _____

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Participant Initials_____Date_____ Witness Initials_____Date_____

Appendix M: Psion Handouts

Psion Psion Psion Psion Psion Psion Psion

1. What is a Psion?

The Psion is a small computer that we are using as a food diary. It can be used for many other things including a word processor and to play games. We won't focus on these other functions.

2. How do I use the Psion as a food diary?

We are going to focus on two functions you will need to use for each meal:

CompDiet is a nutritional database. You enter all foods and beverages for each meal into CompDiet.

Weight asks you to provide other types of information about the meal including where you are and if you were upset before eating.

General Instructions for when and what to enter:
Use the CompDiet program to record all foods and beverages you consume at each meal or snack. A separate entry should be used for each episode of eating or drinking. It is important that you be as complete and exact as possible. Use the Weight program as well to describe the eating situation. We are interested not only in the foods you consume but in the circumstances surrounding your eating. The following line by line instructions will help you in completing the diary. Each program is described in great detail below.

Hot Key List:

⏏ O	Create a diet log.
⏏ V	Enter weight of food in ounces
⏏ X	Exit CompDiet program
⏏ L	View previously entered diet logs
⏏ E	Ammend current item of diet log
⏏ G	View food in database by group

If you want to use the **alarm clock function** on the Psion, feel free to do so. Using the alarm may help you to remember to enter your meals into the Psion!! Once you have set the alarm you must press the SYSTEM icon (it's above the number 2 on the keyboard) in order to exit the alarm clock function.

Please do not hesitate to call us at **(301) 295-9664** if you have any questions or problems with the Psion or the programs.

How to keep your eating diary with CompDiet

1. Turn on the Psion by pressing the ESC key located on the top left corner of the keyboard.

2. Press an **arrow key** ←→ located at the bottom right of the keyboard until you see CompDiet highlighted, press the **Enter key**.

3. On the screen you will see COMCARD COMPUTE-A-DIET, press the **Menu key** located in the bottom left of the keyboard.

4. You will see a **menu bar** that includes pop down menus for the following: View, Add, Change, Analyse, and Misc. Press an **arrow key** ←→ until you get to **Add**, then press the **arrow key** to **Subject** and press **Enter key** when Subject is highlighted.

5. You will see the subject details screen where you need to press **tab key** in order to enter your name, sex, age, weight (**tab key** to get to pounds), height (**tab key** to get to feet and inches) and activity (**tab key** to get to different activity levels). Press the **Enter key** to accept activity level. *Please do not enter a number for Kcals, the program will compute it for you.*

6. Press **Esc key** when done. It will ask you want to save changes, press **Y key** for yes.

7. A warning will appear on the screen, press **Esc key**.

8. You will see the subject details screen again, press **Menu key** to create a Diet log.

Create a Diet Log

9. Under Add on the menu bar, press an **arrow key** ↓↑ to **Diet log(s)**, when highlighted press **Enter key**. A short cut would be to press **key** and the letter **O key** simultaneously to create a new diet log. [The **key** plus any letter key pressed at the same time is called a hot key which is a short cut to executing a command in teh CompDiet program.]

10. Type name of food, pressing the **Enter key** will take you into the food database so you can find the specific type of food you have eaten.

For example if you ate a roasted chicken breast, you would type in chicken, press the Enter key and then press an **arrow key** ↓↑ to locate chicken, breast, meat only, roasted in the food database.

Press **Enter key** to choose the food and the computer will give you an error message asking you to enter a value. Press **Esc key** to get rid of the error message. Press the hot key: **key** and **V key** together so you may enter the weight of the food in ounces. Press the Enter key once you have typed in the amount.

11. Now press the tab key to enter another food into your diet log. Repeat the steps above to enter the rest of your meal.

12. When you are done, press **Menu key** and then press an **arrow key** ⟷ until you get to **Misc** on the menu bar. Press the **arrow key** ↓ **until Exit** is highlighted, then press the **Enter key**. The hot key to exit the program is **key and X key**.

13. The program may ask you if you want to save changes, press **Y key** for yes.

14. Create a new diet log after each meal by using the above directions. It is important for you to enter the foods that you have eaten into a diet log soon after you have completed a meal. The log entries are held indate, time and alphabetical sequence.

Changing a Diet Log Entry:

15. You may go back and check your diet logs to ensure you have properly entered all of the food you have eaten on any given day. The hot key to view the diet log entries is **key** and **L key**. Once you have the diet log entries displayed you may press and ↓ key simultaneously to page down through the diet log quickly.

16. If you realize you have made a mistake entering in a food item, you may change the diet log so it accurately reflects what you have eaten.
    First, be sure you have displayed the diet log entries according to the directions above
    ** Remember, the hot key is L **
    Then you need to page down until you see the food item(s) you want to change.
    Press **Menu** key and a ← → key over to **Change**, under it you will see Amend current item, press an ↑↓ key until it is highlighted and then press the **Enter** key. ** The hot key is **E** **
    Now use the **Tab key** or the ↓ key until the blinking cursor is on the item you need to change.
17. If the food item is wrong, then type in the correct food and press the **Enter key**.
    Now, the food database will appear on your screen, press the ↓ key until you see the food you want to select, press the **Enter key** when the food is highlighted.
    You will see a message asking if you want to save changes, press the Y key if you want the new food item to be in your diet log.
    You should check to make sure that the weight of the food item you just added to your diet log is an accurate reflection of what you ate. The above steps only change the food item while leaving the weight of the incorrect food item.
18. To change the weight of a food you must amend the item as in the directions above by first viewing the diet log entries [**L**] and then changing the entries [**E**]. Next, you need to move the cursor so it is blinking on the weight of the item that needs to be changed. Press **V** to allow you to enter the correct weight of the food in ounces. After you have typed in the number, press the **Enter key**.

19. Press the **Enter key** when you are finished changing any items on a page of the diet log. A message will appear asking if you want to save changes, press the **Y key** to save.

Troubleshooting:

20. When you are working on the psion it may "freeze" up and not allow you to work in the diet software, the pull down menus will not work and you will be unable to enter food into a diet log. If this happens try to exit the CompDiet by pressing the **Menu key** then → **key** over to **Misc** and ↓ key down until **Exit** is highlighted, press the **Enter key**. This should allow you to exit the CompDiet software and bring you back to the main menu that shows all of the other software programs available on the computer. If you are not able to exit CompDiet or get it to run properly, straighten out a paper clip and gently put one end into the little hole in the top left side of the keyboard (just above the Esc key). The screen will go blank and after a minute ress the **ESC key.** You will hear some tones and then you will see a screen with the Psion logo, after 10 - 15 seconds the program icons will appear, but CompDiet will not be there. Do not panic! Press the Menu Key and →key over to Apps, when Install is highlighted press the Enter key. You will see a little message that says:

Install	
File: Name	Compdiet.app
Disk	Internal
Position	Current

21. Do not change anything on this screen, just press the **Enter key** and you will see the CompDiet icon reappear!! Now you are ready to use the CompDiet program again and your diet logs should still contain all of the foods you previously entered. If CompDiet froze while you were adding a meal, then you should view the diet logs to make sure the log is complete.

Diet Log Entry Problems:

If you are ahving a hard time finding a particular food item in the food database try the following steps:

22. While in the diet log entry portion of the program press **Menu key**, then → **key** over to View and ↓ key down until **Food entries by group/nutrient** is highlighted, press the **Enter key**. [The hot key is U G] Now you can specify food group of the food item you are trying to add to you diet log. Press the **Tab key** and a small menu will pop-up on the right side of the screen, now ↓ **key** down until the appropriate food group is highlighted, and press the **Enter key**. You should see the food group category you have chosen on the screen. If you chose the Fast Food category the screen would look something like this:

FOOD/NUTRIENT SELECTION
Press tab for option menus.

Food Grp:	(*Fast Food*)	(not set)
Nutrients-		
non-zero	(not set)	(not set)
zero	(not set)	(not set)

23. Now press the **Enter key** to select the food category. You will see an alphabetical listing of all the foods in that specific category. You can ↓key down until you see the correct food, remember the exact way the food is written so you can enter it into a diet log. Now, to enter this food item you need to go to **Add Diet log(s)** [hot key is ⌴ **O**] and then type in the name of the food exactly as you saw it in the food entries by group section.

Turn Off the Psion:

24. Press ⌴ key and the 1 key simultaneously to turn the Psion off. If you accidently leave the psion on, it will automatically turn off after 5 minutes, but please try and remember to turn it off to save the life of the battery.

Hot Key List

⌴ O	Create a diet log
⌴ V	Enter weight of food in ounces
⌴ X	Exit CompDiet program
⌴ L	View previously entered diet logs
⌴ E	Ammend current item of diet log
⌴ G	View food in database by group

Getting to know the psion (pronounced SIGH-ON)

1. To turn your computer on, hit the Psion key (lower left hand side ---U) and the ESC key (top left hand side).

2. Hit the System tab on the middle (left side) of the computer

3. Select the CompDiet picture by using the left or right arrow keys on the bottom right hand side of the computer to highlight the words "CompDiet"

4. Press enter key

YOU ARE NOW IN COMPDIET ... HERE IS WHERE YOU ENTER YOUR FOODS.

TO ADD SOMETHING TO YOUR FOOD RECORD

1. Psion key and the O
2. Type in the name of the food that you ate (HIT TAB, **NOT** ENTER)
   Hint: Name of food, description
   Ex: Chicken, breast

3. Scroll through the various choices that appear by using the up and down arrows (bottom right hand side of the computer)

4. When you find the item that best matches what you ate, hit ENTER (ONLY ONCE!)

5. Next enter the time that you ate the foods in military time
   a.m. = the same as normal time with except single digit numbers are preceded by 0. For example 6:20 am is 0620. 11:13 am is 1113.

   p.m. = add twelve to the number if the time is after noon.
   For example, 1:00 pm = 1 + 12 = 1300
   For example, 10:23 pm = 10:23 + 12 = 22:23
   Hint: If you enter the foods as you are eating them, simply press the TAB key once and the current date will appear.

6. Now enter the date month, day, and then year
   Hint: If you enter the foods on the day that you ate them, simply press tab once and the current date will appear.

7. Next enter the amount of the food that you ate in either grams or ounces. You must weigh your foods. If you weigh your foods in grams, simply enter the number of grams. PRESS TAB ONCE. (**NOT** ENTER!)

   HINT: TO ENTER FOODS IN OUNCES, HIT THE PSION KEY AND THE V KEY, THEN ENTER THE NUMBER OF OUNCES THAT YOU ATE.

8. PRESS TAB (**NOT** ENTER!)

9. To type in your next food item, repeat steps 2-8.

10. When you have entered all that you ate at a meal, simply press "ENTER" and it will say "USER DATA ADDED". Now your foods have been saved.

To change an entry before it has been saved

Simply, use the up and down keys to move the cursor to where you would like to make a change. Type over your mistake

To change an entry after it has been saved

Psion key and the E
Move cursor to the item you would like to change.
Make corrections
Press enter
Save

To delete an entry after it has been saved

Psion key and the D
Move cursor to the item
Press enter to mark the beginning of where you want to delete
Press enter to mark the last item you would like to delete

Appendix N: Sample 1800-Kilocalorie Menu (Low Fat)

Weekly Menus - LOWFAT

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
BREAKFAST				bagel-cinnamon/raisin-3.5" juice-orange-frozen concentrate-diluted jam/preserves-strawberry-low calorie banana-raw-peeled	coffee-instant-prepared applesauce-canned-unsweetened-usda milk-nonfat/skim-fluid cereal-oatmeal-cooked bread-wheat	cereal-raisin bran-kelloggs coffee-brewed applesauce-canned-unsweetened-usda milk-nonfat/skim-fluid bread-wheat	coffee-decaffeinated-sanka-prepared milk-nonfat/skim-fluid bread-wheat apples-raw-with skin-2 3/4 inch diameter egg-chicken-whole-hard boiled
MORNING							
LUNCH				bread-pita-whole wheat tomato-red-ripe-raw broccoli-raw cheese-feta-ounce orange-raw-all common varieties-whole chocolate pudding	beans-snap-green-frozen-boiled tea-instant-prepared-sweetened bread-wheat turkey-breast-deli-roasted-hillshire soup-country vegetable-home-campbell's potato-mashed-home recipe-milk/butter pineapple-canned-juice pack-usda	tuna-macaroni salad sherbet-orange coffee-decaffeinated-sanka-prepared soup-beef/country vegetable-campbells roll-dinner-wheat	pears-canned-extra light syrup pack bread-stick-garlic-keebler carrots-boiled-drained-sliced cheese lasagna/vegetable-budget light
AFTERNOON							
DINNER				fish-whitefish-raw potato-baked-flesh & skin-whole carrot-raw-scraped-whole beans-green-frozen-boiled-french style bread-wheat	rice-wild-cooked carrots-boiled-drained-sliced milk-nonfat/skim-fluid coffee-brewed cabbage-common-boiled-drained chicken-thigh-meat/skin-roast/broil sauce-barbecue-ready to serve roll-dinner-wheat	creamy cole slaw baked battered fish potato-baked-flesh & skin-whole vegetables-mixed-frozen-boiled pears-halved-canned in water-dietetic milk-nonfat/skim-fluid tea-instant-prepared-unsweetened bread-pumpernickel	biscuit-plain milk-nonfat/skim-fluid chicken-breast-no skin-roast/broil sherbet-rainbow-baskin robin jam/preserves-strawberry-low calorie pasta-spaghetti-ckd-tender cheese-parmesan-grated
EVENING				cereal-cheerios-usda milk-1% fat-lowfat-fluid melons-cantaloup-raw	tortilla chips-plain	strawberries-raw-whole	yogurt-peach/strawberry-lowfat-dannon

Weekly Menus from 11/11/01 to 11/17/01 for week 1

	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
BREAKFAST	muffin-english-plain jam/preserves-strawberry-low calorie juice-orange-frozen concentrate-diluted ham-lean only-roasted coffee-brewed milk-nonfat/skim-fluid	tea-brewed milk-nonfat/skim-fluid omelet-zero cholesterol w/ vegetables-sny potato-hashed brown-prepared from frozen	tangerines-canned-light syrup pack cheese-cottage-1% lowfat-unpacked waffle-nutri-grain-multi bran-kellogg juice-grapefruit-canned-unsweetened				
MORNING							
LUNCH	fish-tuna-light-canned in water-drained mustard-yellow-prepared bagel-sesame seed-3.5" celery-pascal-raw-diced onions-mature-raw-chopped orange-raw-all common varieties-whole ice cream-chocolate	squash-zucchini-raw-boiled popsicle tea-brewed turkey-breast-deli-roasted-hillshire roll-submarine/hoagie-enriched mustard-yellow-prepared cheese-provolone	salad-green salad-tossed cucumber-raw-sliced tomato-red-ripe-raw spinach-raw-chopped turkey-breast-deli-roasted-hillshire avocado-raw-california apples-raw-with skin-2 3/4 inch diameter milk-nonfat/skim-fluid cheese-cheddar-cut pieces				
AFTERNOON							
DINNER	salad-green salad-tossed broccoli-raw peppers-sweet-raw roll-dinner-wheat salmon-vegetable salad	sweet and sour pork milk-nonfat/skim-fluid tea-brewed rice-white-long grain-enr-cooked sauce-teriyaki-cd01400-kikkoman pineapple-canned-juice pack-usda cookie-fortune-la choy	chicken-breast-no skin-roast/broil rice-white-long grain-enr-cooked broccoli-raw-boiled-drained bread-wheat				
EVENING	brownie mix/with walnuts milk-nonfat/skim-fluid	popcorn-popped-plain cheese-parmesan-grated	cookie-sandwich-choc/cream filling tea-herbal-brewed				

Low Fat Day 6
Total Calories: 1856
% Fat: 18
% Protein: 22
% Carbohydrates: 60

Description	Amount	Portion	Classification
Monday, November 12, 2001 (20 foods, 1856 Cals)			
Breakfast (4 foods, 311 Cals)			
OMELET-ZERO CHOLESTEROL W/VEGETABLES-SNY	3.000	OUNCE	Main Entree
POTATO-HASHED BROWN-PREPARED FROM FROZEN	2.500	OUNCE	Side Item
TEA-BREWED	6.500	FL OZ	Beverage
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
Lunch (7 foods, 594.7 Cals)			
TURKEY-BREAST-DELI-ROASTED-HILLSHIRE	3.000	OUNCE	Main Entree
ROLL-SUBMARINE/HOAGIE-ENRICHED	3.500	OUNCE	Main Entree
CHEESE-PROVOLONE	1.000	OUNCE	Main Entree
SQUASH-ZUCCHINI-RAW-BOILED	3.000	OUNCE	Side Item
TEA-BREWED	6.000	OUNCE	Beverage
POPSICLE	1.000	OUNCE	Dessert
MUSTARD-YELLOW-PREPARED	30.000	GRAM	Condiment
Dinner (7 foods, 814.2 Cals)			
*SWEET AND SOUR PORK	1.000	SERVING	Main Entree
RICE-WHITE-LONG GRAIN-ENR-COOKED	5.600	OUNCE	Side Item
SAUCE-TERIYAKI-CD01400-KIKKOMAN	3.000	OUNCE	Side Item
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
TEA-BREWED	6.000	FL OZ	Beverage
PINEAPPLE-CANNED-JUICE PACK-USDA	9.000	OUNCE	Dessert
COOKIE-FORTUNE-LA CHOY	1.000	OUNCE	Dessert
Evening (2 foods, 136.6 Cals)			
POPCORN-POPPED-PLAIN	0.500	OUNCE	Main Entree
CHEESE-PARMESAN-GRATED	0.600	OUNCE	Side Item

* Recipe Attached

Low Fat Day 1
Total Calories: 1784
% Fat: 22
% Protein: 25
% Carbohydrates: 53

Description	Amount	Portion	Classification
Tuesday, November 13, 2001 (19 foods, 1784 Cals)			
Breakfast (4 foods, 526.7 Cals)			
CHEESE-COTTAGE-1 % LOWFAT-UNPACKED	8.000	OUNCE	Main Entree
WAFFLE-NUTRI-GRAIN-MULTI BRAN-KELLOGG	1.500	OUNCE	Main Entree
TANGERINES-CANNED-LIGHT SYRUP PACK	9.000	OUNCE	Side Item
JUICE-GRAPEFRUIT-CANNED-UNSWEETENED	8.000	OUNCE	Beverage
Lunch (9 foods, 613.4 Cals)			
SALAD-GREEN SALAD-TOSSED	14.000	OUNCE	Main Entree
TURKEY-BREAST-DELI-ROASTED-HILLSHIRE	3.000	OUNCE	Main Entree
CUCUMBER-RAW-SLICED	2.000	OUNCE	Side Item
TOMATO-RED-RIPE-RAW	2.000	OUNCE	Side Item
SPINACH-RAW-CHOPPED	1.000	OUNCE	Side Item
AVOCADO-RAW-CALIFORNIA	3.000	OUNCE	Side Item
APPLES-RAW-WITH SKIN-2 3/4 INCH DIAMETER	5.000	OUNCE	Side Item
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Side Item
CHEESE-CHEDDAR-CUT PIECES	1.000	OUNCE	Side Item
Dinner (4 foods, 548.2 Cals)			
*E CHICKEN-BREAST-NO SKIN-ROAST/BROIL	3.000	OUNCE	Main Entree
RICE-WHITE-LONG GRAIN-ENR-COOKED	6.000	OUNCE	Main Entree
BROCCOLI-RAW-BOILED-DRAINED	5.000	OUNCE	Side Item
BREAD-WHEAT	2.000	OUNCE	Side Item
Evening (2 foods, 95.78 Cals)			
COOKIE-SANDWICH-CHOC/CREAM FILLING	2.000	ITEM	Main Entree
TEA-HERBAL-BREWED	6.000	FL OZ	Side Item

* Chicken-n-Rice Recipe

Shopping List for week 1 LOW FAT

FRUITS		**Portion**	**Dry Weight**
235	BANANA-RAW-PEELED	6.000 OUNCES	6.000 OUNCES
273	ORANGE-RAW-ALL COMMON VARIETIES-WHOLE	10.00 OUNCES	10.00 OUNCES
5628	MELONS-CANTALOUP-RAW	3.000 OUNCES	3.000 OUNCES
227	APPLESAUCE-CANNED-UNSWEETENED-USDA	8.000 OUNCES	8.000 OUNCES
45	PEARS-HALVED-CANNED IN WATER-DIETETIC	4.000 OUNCES	4.000 OUNCES
313	STRAWBERRIES-RAW-WHOLE	5.000 OUNCES	5.000 OUNCES
3048	PEARS-CANNED-EXTRA LIGHT SYRUP PACK	4.500 OUNCES	4.500 OUNCES
223	APPLES-RAW-WITH SKIN-2 3/4 INCH DIAMETER	10.00 OUNCES	10.00 OUNCES
1039	TANGERINES-CANNED-LIGHT SYRUP PACK	9.000 OUNCES	9.000 OUNCES
233	AVOCADO-RAW-CALIFORNIA	3.000 OUNCES	3.000 OUNCES
VEGETABLES		**Portion**	**Dry Weight**
671	TOMATO-RED-RIPE-RAW	4.000 OUNCES	4.000 OUNCES
567	BROCCOLI-RAW	3.000 OUNCES	3.000 OUNCES
1144	POTATO-BAKED-FLESH & SKIN-WHOLE	0.991 ITEMS	7.063 OUNCES
600	CARROT-RAW-SCRAPED-WHOLE	0.500 ITEMS	1.270 OUNCES
573	BEANS-GREEN-FROZEN-BOILED-FRENCH STYLE	0.250 CUPS	1.190 OUNCES
572	BEANS-SNAP-GREEN-FROZEN-BOILED	2.300 OUNCES	2.300 OUNCES
602	CARROTS-BOILED-DRAINED-SLICED	7.000 OUNCES	7.000 OUNCES
595	CABBAGE-COMMON-BOILED-DRAINED	2.000 OUNCES	2.000 OUNCES
652	POTATO-MASHED-HOME RECIPE-MILK/BUTTER	4.000 OUNCES	4.000 OUNCES
680	VEGETABLES-MIXED-FROZEN-BOILED	3.200 OUNCES	3.200 OUNCES
609	CELERY-PASCAL-RAW-DICED	1.000 OUNCE	28.35 GRAMS
633	ONIONS-MATURE-RAW-CHOPPED	1.000 OUNCE	28.35 GRAMS
643	PEPPERS-SWEET-RAW	3.000 OUNCES	3.000 OUNCES
1112	SQUASH-ZUCCHINI-RAW-BOILED	3.000 OUNCES	3.000 OUNCES
650	POTATO-HASHED BROWN-PREPARED FROM FROZEN	2.500 OUNCES	2.500 OUNCES
619	CUCUMBER-RAW-SLICED	2.000 OUNCES	2.000 OUNCES
659	SPINACH-RAW-CHOPPED	1.000 OUNCE	28.35 GRAMS
588	BROCCOLI-RAW-BOILED-DRAINED	5.000 OUNCES	5.000 OUNCES
BREAKFAST CEREALS		**Portion**	**Dry Weight**
1206	CEREAL-CHEERIOS-USDA	1.000 OUNCE	28.35 GRAMS
366	CEREAL-OATMEAL-COOKED	8.300 OUNCES	8.300 OUNCES
1242	CEREAL-RAISIN BRAN-KELLOGGS	2.600 OUNCES	2.600 OUNCES
BREADS		**Portion**	**Dry Weight**
8534	BAGEL-CINNAMON/RAISIN-3.5"	71.00 GRAMS	2.504 OUNCES
7905	BREAD-PITA-WHOLE WHEAT	2.300 OUNCES	2.300 OUNCES
8670	BREAD-WHEAT	9.000 OUNCES	4.000 OUNCES
9039	ROLL-DINNER-WHEAT	6.000 OUNCES	4.000 OUNCES
338	BREAD-PUMPERNICKEL	2.000 OUNCES	2.000 OUNCES
8540	BISCUIT-PLAIN	2.000 OUNCES	2.000 OUNCES
7284	BREAD-STICK-GARLIC-KEEBLER	2.000 OUNCES	2.000 OUNCES
9121	MUFFIN-ENGLISH-PLAIN	2.000 OUNCES	2.000 OUNCES
8529	BAGEL-SESAME SEED-3.5″	2.500 OUNCES	2.500 OUNCES
491	ROLL-SUBMARINE/HOAGIE-ENRICHED	3.500 OUNCES	3.500 OUNCES
10189	WAFFLE-NUTRI-GRAIN-MULTI BRAN-KELLOGG	1.500 OUNCES	1.500 OUNCES
GRAINS		**Portion**	**Dry Weight**
1994	RICE-WILD-COOKED	6.000 OUNCES	6.000 OUNCES
4641	TORTILLA CHIPS-PLAIN	1.000 OUNCE	28.35 GRAMS
494	PASTA-SPAGHETTI-CKD-TENDER	2.500 OUNCES	2.500 OUNCES
484	RICE-WHITE-LONG GRAIN-ENR-COOKED	11.60 OUNCES	11.60 OUNCES
476	POPCORN-POPPED-PLAIN	0.500 OUNCES	14.18 GRAMS
SOUPS		**Portion**	**Dry Weight**
7598	SOUP-COUNTRY VEGETABLE-HOME-CAMPBELL'S	6.000 OUNCES	6.000 OUNCES
3718	SOUP-BEEF/COUNTRY VEGETABLE-CAMPBELLS	6.000 OUNCES	6.000 OUNCES
BEVERAGES		**Portion**	**Dry Weight**
278	JUICE-ORANGE-FROZEN CONCENTRATE-DILUTED	2.000 CUPS	1.098 POUNDS
732	COFFEE-INSTANT-PREPARED	1.000 CUP	8.430 OUNCES
735	TEA-INSTANT-PREPARED-SWEETENED	1.000 CUP	9.136 OUNCES
731	COFFEE-BREWED	20.00 FL OZS	14.62 OUNCES
1019	PINEAPPLE-CANNED-JUICE PACK-USDA	13.40 OUNCES	13.40 OUNCES
1480	COFFEE-DECAFFEINATED-SANKA-PREPARED	8.000 FL OZS	8.409 OUNCES
734	TEA-INSTANT-PREPARED-UNSWEETENED	1.000 CUP	8.360 OUNCES
733	TEA-BREWED	18.50 FL OZS	13.05 OUNCES
250	JUICE-GRAPEFRUIT-CANNED-UNSWEETENED	8.000 OUNCES	8.000 OUNCES
1877	TEA-HERBAL-BREWED	6.000 FL OZS	6.265 OUNCES
SAUCES & DIPS		**Portion**	**Dry Weight**
685	SAUCE-BARBECUE-READY TO SERVE	15.00 GRAMS	15.00 GRAMS

700	MUSTARD-YELLOW-PREPARED	58.00 GRAMS	2.046 OUNCES
2507	SAUCE-TERIYAKI-CD01400-KIKKOMAN	3.000 OUNCES	3.000 OUNCES
DAIRY PRODUCTS		Portion	Dry Weight -
890	CHEESE-FETA-OUNCE	1.000 OUNCE	28.35 GRAMS
54	MILK-1% FAT-LOWFAT-FLUID	1.000 CUP	8.607 OUNCES
57	MILK-NONFAT/SKIM-FLUID	10.12 CUPS	1.080 POUNDS
3835	YOGURT-PEACH/STRAWBERRY-LOWFAT-DANNON	6.600 OUNCES	6.600 OUNCES
14	CHEESE-PARMESAN-GRATED	1.600 OUNCES	1.600 OUNCES
17	CHEESE-PROVOLONE	1.000 OUNCE	28.35 GRAMS
9	CHEESE-COTTAGE-1% LOWFAT-UNPACKED	8.000 OUNCES	8.000 OUNCES
3	CHEESE-CHEDDAR-CUT PIECES	1.000 OUNCE	28.35 GRAMS
EGGS		Portion	Dry Weight -
5221	EGG-CHICKEN-WHOLE-HARD BOILED	2.000 OUNCES	2.000 OUNCES
10753	OMELET-ZERO CHOLESTEROL W/VEGETABLES-SNY	3.000 OUNCES	3.000 OUNCES
MEATS		Portion	Dry Weight -
1319	HAM-LEAN ONLY-ROASTED	2.000 OUNCES	2.000 OUNCES
POULTRY		Portion	Dry Weight -
7124	TURKEY-BREAST-DELI-ROASTED-HILLSHIRE	9.000 OUNCES	6.000 OUNCES
3216	CHICKEN-THIGH-MEAT/SKIN-ROAST/BROIL	3.000 OUNCES	3.000 OUNCES
1276	CHICKEN-BREAST-NO SKIN-ROAST/BROIL	6.000 OUNCES	6.000 OUNCES
FISH		Portion	Dry Weight -
2966	FISH-WHITEFISH-RAW	4.000 OUNCES	4.000 OUNCES
355	FISH-TUNA-LIGHT-CANNED IN WATER-DRAINED	3.000 OUNCES	3.000 OUNCES
DESSERTS		Portion	Dry Weight -
85	SHERBET-ORANGE	3.300 OUNCES	3.300 OUNCES
10481	SHERBET-RAINBOW-BASKIN ROBIN	4.000 OUNCES	4.000 OUNCES
4776	ICE CREAM-CHOCOLATE	2.000 OUNCES	2.000 OUNCES
8869	BROWNIE MIX/WITH WALNUTS	2.000 OUNCES	2.000 OUNCES
707	POPSICLE	1.000 ITEM	3.351 OUNCES
7241	COOKIE-FORTUNE-LA CHOY	1.000 OUNCE	28.35 GRAMS
8906	COOKIE-SANDWICH-CHOC/CREAM FILLING	2.000 ITEMS	20.00 GRAMS
SUGARS & SWEETS		Portion	Dry Weight -
562	JAM/PRESERVES-STRAWBERRY-LOW CALORIE	3.205 OUNCES	2.570 OUNCES
FROZEN DINNERS		Portion	Dry Weight -
3987	CHEESE LASAGNA/VEGETABLE-BUDGET LIGHT	1.000 ITEM	10.51 OUNCES
COMBINATION FOODS		Portion	Dry Weight -
1826	SALAD-GREEN SALAD-TOSSED	26.00 OUNCES	1.625 POUNDS
RECIPES		Portion	Dry Weight -
25032	CHOCOLATE PUDDING	6.000 OUNCES	6.000 OUNCES
25115	TUNA-MACARONI SALAD	1.000 CUP	7.937 OUNCES
25080	BAKED BATTERED FISH	3.000 OUNCES	3.000 OUNCES
25117	SALMON-VEGETABLE SALAD	1.000 SERVING	6.772 OUNCES
25266	SWEET AND SOUR PORK	1.000 SERVING	7.196 OUNCES
SUPPLEMENTS		Portion	Dry Weight -
25271	CREAMY COLE SLAW	1.000 SERVING	1.972 OUNCES

Low Fat Day 1
Total Calories: 1704
% Fat: 15
% Protein: 16
% Carbohydrates: 68

Description	Amount	Portion	Classification
Wednesday, November 07, 2001 (18 foods, 1704 Cals)			
Breakfast (4 foods, 511.8 Cals)			
BAGEL-CINNAMON/RAISIN-3.5"	71.000	GRAM	Main Entree
BANANA-RAW-PEELED	6.000	OUNCE	Main Entree
JUICE-ORANGE-FROZEN CONCENTRATE-DILUTED	1.000	CUP	Side Item
JAM/PRESERVES-STRAWBERRY-LOW CALORIE	1.300	OUNCE	Condiment
Lunch (6 foods, 516.4 Cals)			
BREAD-PITA-WHOLE WHEAT	2.300	OUNCE	Main Entree
CHEESE-FETA-OUNCE	1.000	OUNCE	Main Entree
TOMATO-RED-RIDE-RAW	2.000	OUNCE	Side Item
BROCCOLI-RAW	1.000	OUNCE	Side Item
ORANGE-RAW-ALL COMMON VARIETIES-WHOLE	5.000	OUNCE	Side Item
CHOCOLATE PUDDING	6.000	OUNCE	Beverage
Dinner (5 foods, 434 Cals)			
FISH-WHITEFISH-RAW	4.000	OUNCE	Main Entree
POTATO-BAKED-FLESH & SKIN-WHOLE	0.500	ITEM	Main Entree
CARROT-RAW-SCRAPED-WHOLE	0.500	ITEM	Main Entree
BEANS-GREEN-FROZEN-BIOLED-FRENCH STYLE	0.250	CUP	Main Entree
BREAD-WHEAT	2.000	OUNCE	Main Entree
Evening (3 foods, 242.6 Cals)			
CEREAL-CHEERIOS-USDA	1.000	OUNCE	Main Entree
MELONS-CANTALOUP-RAW	3.000	OUNCE	Main Entree
MILK-1% FAT-LOWFAT-FLUID	1.000	CUP	Side Item

* Denotes recipe (Fish ; Foil)

Low Fat Day 2
Total Calories: 1782
% Fat: 19
% Protein: 20
% Carbohydrates: 60

Description	Amount	Portion	Classification
Thursday, November 08, 2001 (21 foods, 1782 Cals)			
Breakfast (5 foods, 359.1 Cals)			
CEREAL-OATMEAL-COOKED	8.300	OUNCE	Main Entree
APPLESAUCE-CANNED-UNSWEETENED	4.000	OUNCE	Side Item
BREAD-WHEAT	1.000	OUNCE	Side Item
COFFEE-INSTANT-PREPARED	1.000	CUP	Beverage
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
Lunch (7 foods, 608.1 Cals)			
BREAD-WHEAT	2.000	OUNCE	Main Entree
TURKEY-BREAST-DELI-ROASTED-HILLSHIRE	3.000	OUNCE	Main Entree
SOUP-COUNTRY VEGETABLE-HOME-CAMPBELL'S	6.000	OUNCE	Main Entree
BEANS-SNAP-GREEN-FROZEN-BOILED	2.300	OUNCE	Side Item
POTATO-MASHED-HOME RECIPE-MILK/BUTTER	4.000	OUNCE	Side Item
TEA-INSTANT-PREPARED-SWEETENED	1.000	CUP	Beverage
PINEAPPLE-CANNED-JUICE PACK-USDA	4.400	OUNCE	Dessert
Dinner (8 foods, 674.1 Cals)			
CHICKEN-THIGH-MEAT/SKIN-ROAST/BROIL	3.000	OUNCE	Main Entree
RICE-WILD-COOKED	6.000	OUNCE	Side Item
CARROTS-BOILED-DRAINED-SLICED	2.000	OUNCE	Side Item
CABBAGE-COMMON-BOILED DRAINED	2.000	OUNCE	Side Item
ROLL-DINNER-WHEAT	2.000	OUNCE	Side Item
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
COFFEE-BREWED	6.000	FL OZ	Beverage
SAUCE-BARBECUE-READY TO SERVE	15.000	GRAM	Condiment
Evening (1 foods, 141.8 Cals)			
TORTILLA CHIPS-PLAIN	1.000	OUNCE	Side Item

Low Fat Day 3
Total Calories: 1856
% Fat: 19
% Protein: 17
% Carbohydrates: 64

Description	Amount	Portion	Classification
Friday, November 09, 2001 (19 foods, 1856 Cals)			
Breakfast (5 foods, 442.8 Cals)			
CEREAL-RAISIN BRAN-KELLOGGS	2.600	OUNCE	Main Entree
BREAD-WHEAT	1.000	OUNCE	Main Entree
APPLESAUCE-CANNED-UNSWEETENED-USDA	4.000	OUNCE	Side Item
COFFEE-BREWED	6.000	FL OZ	Beverage
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
Lunch (5 foods, 660.3 Cals)			
TUNA-MACARONI SALAD	1.000	CUP	Main Entree
SOUP-BEEF/COUNTRY VEGETABLE-CAMPBELLS	6.000	OUNCE	Main Entree
ROLL-DINNER-WHEAT	2.000	OUNCE	Side Item
COFFEE-DECAFFEINATED-SANKA-PREPARED	4.000	FL OZ	Beverage
SHERBET-ORANGE	3.300	OUNCE	Dessert
Dinner (8 foods, 711.2 Cals)			
BAKED BATTERED FISH	3.000	OUNCE	Main Entree
POTATO-BAKED-FLESH & SKIN-WHOLE	3.500	OUNCE	Side Item
VEGETABLES-MIXED-FROZEN-BOILED	3.200	OUNCE	Side Item
BREAD-PUMPERNICKEL	2.000	OUNCE	Side Item
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
TEA-INSTANT-PREPARED-UNSWEETENED	1.000	CUP	Beverage
PEARS-HALVED-CANNED IN WATER-DIETETIC	4.000	OUNCE	Dessert
* CREAMY COLE SLAW	1.000	SERVING	Salad
Evening (1 foods, 42.53 Cals)			
STRAWBERRIES-RAW-WHOLE	5.000	OUNCE	SideItem

* Recipe

Low Fat Day 4
Total Calories: 1880
% Fat: 20
% Protein: 23
% Carbohydrates: 57

Description	Amount	Portion	Classification
Saturday, November 10, 2001 (17 foods, 1880 Cals)			
Breakfast (5 foods, 332.3 Cals)			
BREAD-WHEAT	1.000	OUNCE	Main Entree
EGG-CHICKEN-WHOLEHARD BOILED	2.000	OUNCE	Main Entree
APPLES-RAW-WITH SKIN 2 3/4 INCH DIAMETER	5.000	OUNCE	Side Item
COFFEE-DECAFFEINATED-SANKA-PREPARED	4.000	FL OZ	Beverage
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
Lunch (4 foods, 640.5 Cals)			
*CHEESE LASAGNA/VEGETABLE-BUDGET LIGHT	1.000	ITEM	Main Entree
BREAD-STICK-GARLIC-KEEBLER	2.000	OUNCE	Side Item
CARROTS-BOILED-DRAINED-SLICED	5.000	OUNCE	Side Item
PEARS-CANNED-EXTRA LIGHT SYRUP PACK	4.500	OUNCE	Dessert
Dinner (7 foods, 817.7 Cals)			
CHICKEN-BREAST-NO SKIN-ROAST/BROIL	3.000	OUNCE	Main Entree
BISCUIT-PLAIN	2.000	OUNCE	Side Item
PASTA-SPAGHETTI-CKD-TENDER	2.500	OUNCE	Side Item
CHEESE-PARMESAN-GRATED	1.000	OUNCE	Side Item
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Beverage
SHERBERT-RAINBOW-BASKIN ROBIN	4.000	OUNCE	Dessert
AM/PRESERVES-STRAWBERRY-LOW CALORIE	18.000	GRAM	Condiment
Evening (1 foods, 89.81 Cals)			
YOGURT-PEACH/STRAWBERRY-LOWFAT-DANNON	6.600	OUNCE	Side Item

* Spinach Lasagna Recipe

Low Fat Day 5
Total Calories: 1708
% Fat: 20
% Protein: 21
% Carbohydrates: 59

Description	Amount	Portion	Classification
Sunday, November 11, 2001 (20 foods, 1708 Cals)			
Breakfast (6 foods, 397.1 Cals)			
MUFFIN-ENGLISH-PLAIN	2.000	OUNCE	Main Entree
HAM-LEAN ONLY-ROASTED	2.000	OUNCE	Main Entree
JUICE-ORANGE-FROZEN CONCENTRATE-DILUTED	1.000	CUP	Side Item
COFFEE-BREWED	8.000	FL OZ	Side Item
MILK-NOFAT/SKIM-FLUID	1.000	OUNCE	Side Item
JAM/PRESERVES-STRAWBERRY-LOW CALORIE	36.000	GRAM	Condiment
Lunch (7 foods, 526.3 Cals)			
FISH-TUNA-LIGHT-CANNED IN WATER-DRAINED	3.000	OUNCE	Main Entree
CELERY-PASCAL-RAW-DICED	1.000	OUNCE	Main Entree
ONIONS-MATURE-RAW-CHOPPED	1.000	OUNCE	Main Entree
BAGEL-SESAME SEED-3.5"	2.500	OUNCE	Side Item
ORANGE-RAW-ALL COMMON VARIETIES-WHOLE	5.000	OUNCE	Side Item
ICE CREAM-CHOCOLATE	2.000	OUNCE	Beverage
MUSTARD-YELLOW-PREPARED	28.000	GRAM	Condiment
Dinner (5 foods, 453.2 Cals)			
* SALMON-VEGETABLE SALAD	1.000	SERVING	Main Entree
BROCCOLI-RAW	2.000	OUNCE	Side Item
PEPPERS-SWEET-RAW	3.000	OUNCE	Side Item
ROLL-DINNER-WHEAT	2.000	OUNCE	Side Item
SALAD-GREEN SALAD-TOSSED	12.000	OUNCE	Dessert
Evening (2 foods, 331.6 Cals)			
MILK-NONFAT/SKIM-FLUID	1.000	CUP	Side Item
BROWNIE MIX/WITH WALNUTS	2.000	OUNCE	Dessert

* Salmon Croquette recipe
Try it w/ Low Fat white sauce!

TUNA-MACARONI SALAD

Servings: 4

Ingredients:

6 oz. Water packed tuna
2 cups Cooked macaroni noodles
1 Tbsp Finely chopped onion
½ cup Chopped celery
2 Tbsp Finely chopped green pepper
1/3 cup Mayonnaise type salad dressing
1 tsp Prepared mustard
1 tsp Lemon juice
4 small lettuce leaves

Instructions:

Cook macaroni noodles in one quart of boiling water until tender and then drain. Toss tuna, macaroni, and vegetables together lightly. Mix salad dressing, mustard, and lemon juice. Gently stir into tuna-macaroni mixture. Chill. Portion onto crisp salad greens.

Per serving: 269 calories, 7 grams fat, 3 grams fiber, 358 grams sodium

CREAMY COLE SLAW

Servings: 4

Ingredients:

1-1/2 cups Coarsely chopped cabbage
1/4 cups Finely shredded carrots
1 Tbsp Chopped fresh onions
1 Tbsp Chopped green pepper
2 Tbsp Mayonnaise
1/2 tsp Sugar
1/2 tsp Celery seed
1/4 tsp Dry mustard
1 Tbsp Vinegar

Instructions:

Place all vegetables in large bowl and toss lightly to mix.
Combine mayonnaise, sugar, celery seed, dry mustard, and vinegar.
Pour dressing over vegetables. Mix thoroughly. Cover. Refrigerate until ready to serve. Mix lightly before serving.

Per serving: 86 calories, 1 gram fat, 1 gram fiber, 65 mg sodium

CHICKEN 'N RICE CASSEROLE

This is an easy recipe, but requires an extended cooking time. Perfect for a relaxing Sunday at home, pop in the oven mid-afternoon to serve up for supper. Delicious with fresh steamed broccoli, crusty bread, and fruit salad.

6 chicken breasts, skinned
1 cup brown rice
1 1/2 cup chicken broth
1 1/2 cup skim milk
1/2 cup celery, chopped
1/2 teaspoon oregano
1/2 teaspoon salt
1/4 teaspoon black pepper

1. Spray a shallow 2 quart casserole with cooking spray.
2. In casserole dish, combine all ingredients, except chicken, mixing well.
3. Arrange chicken breasts atop rice mixture.
4. Bake covered at 250 degrees for 2 1/2 to 3 hours.

6 servings, chicken breast plus rice.

Per serving: 273 calories, 2.5 grams fat, 1.5 grams fiber, 513 mg sodium

SALMON CROQUETTES

A traditional favorite! Serve with low-fat white sauce.

1 can (15 oz.) salmon
1/4 cup onion finely chopped
3/4 cup bread crumbs
1 egg, slightly beaten
1 tablespoon lemon juice
1/4 teaspoon pepper
1/4 teaspoon nutmeg

1. Combine all ingredients in a bowl and mix well.
2. Cover and refrigerate the salmon mixture for an hour or more.
3. After chilling, shape into 4 patties approximately 3/4 inch thick.
4. Pan "fry" in a nonstick skillet sprayed with cooking spray over moderate heat until browned on each side.

4 servings

Per serving 173 calories, 5.5 grams fat, 1 gram fiber, 433 sodium

LOWFAT WHITE SAUCE

1/4 cup chicken or vegetable stock
1/4 cup flour or 2 tablespoons cornstarch
2 cup skim milk
1/2 cup nonfat dry milk
1 bay leaf
1/2 teaspoon thyme
1/2 teaspoon white pepper
1 teaspoon vegetable seasoning (optional)

1. Heat chicken or vegetable stock over moderate heat in a saucepan.
2. Gradually add flour and blend with a wire whisk or wooden spoon.
3. Simmer and continue to stir--do not allow to brown.
4. Remove from heat and add remaining ingredients.
5. Return to heat and cook until thickened.

Makes 2 1/2 cups. Serving size is 1/4 cup.

Per serving: 42 calories, 0 grams fat, 0 grams fiber, 63 mg. sodium

FISH AND VEGETABLES IN FOIL

A delicious and simple solution for those fish fillets in the freezer.

1 pound frozen fish fillets
1/4 teaspoon dried dill weed
2 tablespoons lemon juice
4 slices onion
2 medium potatoes, cut into 1/4" strips
2 medium carrots, cut into 1/8" slices
1 cup frozen Italian green beans

1. Place each frozen fish fillet in the center of an individual piece foil, 12" X 18".
2. Combine dill and lemon juice. Drizzle over fillets in foil.
3. Top with onion slices. Arrange potatoes and carrots on sides of fillets. Top with green beans.
4. Seal foil tightly and place on ungreased cookie sheet.
5. Bake at 425 degrees till fork tender, about 30 minutes.

Serves 4

Per serving: 189 calories, 1.5 grams fat, 3 grams fiber, 157 mg. sodium

BASIC BETTER BEANS (Rotation Diet Cookbook)

2 cups dried beans
4 cups chicken stock
2 large onions
6 whole cloves
1 tablespoon olive oil
dash of salt and pepper

1. Place the beans in a pot with the stock. Peel the onions, stick the whole cloves in them, and place in the pot with the beans. Soak overnight.
2. Remove the onions and cloves, bring the beans to a boil, then reduce the heat and cook, covered, until just tender, about 3 hours.
3. Discard the cloves, chop the onions, and saute in the oil (add a little water if necessary to prevent sticking) until translucent.
4. Place all ingredients in a casserole and bake for 1 hour at 325 degrees.

8 servings. Serving size is about 1/2 cup.

Per Serving: 172 calories, 4 grams fat, 1 gram fiber, 438 mg. sodium

CORN MUFFINS

This version of the delicious corn muffins found at the famous Wayside Inn in Sudbury, Massachusetts. The honey and oil make them sweet and tender!

1/3 cup sugar
2 tablespoons baking powder
3 1/2 cup all-purpose flour
1 cup yellow corn meal
1/4 teaspoon salt
1/2 cup honey
2 whole eggs
3 egg whites
1 3/4 cup skim milk
1/4 cup vegetable oil

1. In a large bowl, whisk together the honey, eggs, milk, oil.
2. Add dry ingredients and mix with an electric mixer at medium-high 2 minutes.
3. Spray a muffin tin with nonstick spray or line with baking cups. Fill muffin cups 3/4 full. Bake in a preheated oven at 400 degrees for about 15 minutes or until tops are golden brown.

Makes 24 servings
Per serving: 155 calories, 3 grams fat, 1 gram fiber, 104 mg sodium

BAKED FLANK STEAK

1 1/2 pounds flank steak
1 tablespoon vegetable oil
1 cup hot water
1 bay leaf
1 large clove garlic, crushed
1 teaspoon salt
4 tablespoons minced celery
1/8 teaspoon fresh-ground black pepper
2 teaspoons lemon juice
1 medium carrot, diced
1/4 medium bell pepper, diced

1. Trim away any visible fat from the steak. Sear the steak in the oven medium to medium-high heat. Remove the pan from the heat. Place the steak in a casserole dish.
2. For extra flavoring, pour the water into the cooled skillet and stir. Pour this over the meat, then add all the other ingredients.
3. Cook uncovered at 350 degrees for 30 minutes or longer if you prefer your meat well-done.

4 servings of 4 1/2 ounces each (cooked weight)

Per serving: 235 calories, 9 grams fat, 1 gram fiber, 600 mg sodium

ROYAL INDIAN SALMON

4 salmon steaks, 1 inch thick (about 6 ounces each)
1/4 cup chicken or vegetable stock
2 tablespoons lemon juice
1/2 teaspoon fennel seeds, crushed
1/4 teaspoon cumin
1/4 teaspoon coriander
Dash of salt and fresh-ground black pepper

1. Place the steaks in a shallow baking pan. Pour the stock and the lemon juice over the steaks. Add the seasonings. Marinate, covered in the refrigerator for at least two hours, turning the steaks occasionally.
2. To cook, place the steaks on a foil-covered broiling pan. Spoon 2 teaspoons of the marinade on top of each steak. Place under the broiler on low broil for 8 to 10 minutes, or until slightly brown on the edges. Turn steaks over, spoon on the remaining marinade, and broil for an additional 8 to 10 minutes.

4 servings of about 4 1/2 ounces each (cooked weight)

Per serving: 215 calories, 8 grams fat, 0 fiber, 198 mg. sodium

SKIMPY OYSTER ROCKEFELLER

1 pkg. chopped spinach drained and thawed
3 tbsp. dry bread crumbs
2 tsp. olive oil
1 tbsp. grated onion
seasonings: tarragon, pepper, and/or Tabasco sauce
2 tbsp. Grated part-skim mozzarella cheese mixed with 1 tbsp. parmesan
6 ounce raw oyster or canned

Combine bread crumbs, oil, onion, and seasonings. Toss with spinach. Broil oysters, if raw, 5 to 7 minutes. Drain liquid. Top with spinach mixture and broil 3 to 4 minutes. Sprinkle with cheese and broil just until melted.

BRAN MUFFINS WITH APPLESAUCE

1 1/2 cup bran cereal (All-Bran, 100% Bran, etc.)
1 cup skim milk
1 egg, slightly beaten
1/2 cup applesauce
1 tablespoon margarine, melted
1 cup flour
2 1/2 teaspoon baking powder
1/4 cup brown sugar

1. Combine bran cereal and milk. Set aside.
2. Combine egg, applesauce, and margarine. Stir in cereal and milk mixture.
3. Add the dry ingredients. Stir just until blended.
4. Spray a muffin tin with nonstick spray or line with baking cups. Fill muffins cups 3/4 full.
5. Bake in a preheated oven at 400 degrees about 15 minutes or until browned.

Variations: Stir in 1/2 cup raisins or diced apple after step 4.

Makes 12 muffins

Per serving: 107 calories, 1.5 grams fat, 4 grams of fiber, 220 mg. of sodium

BAKED LEMON CHICKEN WITH VEGETABLES

4 chicken breasts, skinned and boned, abou1 4.5-5 ounces each
1 clove garlic, crushed
1/2 teaspoon oregano
Dash of salt
Fresh-ground black pepper to taste
2 medium zucchinis, sliced
1 medium green pepper, sliced in strips
1/2 cup chicken stock
3 tablespoons lemon juice
1 tablespoon white wine

1. Place the chicken in a casserole dish. Top with the garlic, the other seasonings, and the vegetables. Pour in the stock, lemon juice and wine.
2. Cover tightly and bake at 350 degrees for 30 minutes or until chicken is cooked through.

Variations: Include sliced summer squash.

4 servings of 3.5 ounces meat (cooked weight), plus vegetables.

Per serving: 164 calories, 7 grams fat, 1 gram fiber, 162 mg. sodium

QUICK TURKEY LOAF (Rotation Diet Cookbook)

1 1/2 pound lean ground turkey
3/4 cup dry bread crumbs
1 tablespoon soy sauce
1/4 cup chicken or turkey stock
1 teaspoon Worcestershire sauce
Fresh-ground pepper to taste
1/2 teaspoon each thyme, marjoram, and basil
1 teaspoon dried parsley
1 large egg, lightly beaten

1. Preheat the oven to 350 degrees.
2. Blend all the ingredients thoroughly in a mixing bowl and bake uncovered in a 9 X 5 X 3-inch loaf pan for 1 hour. Let stand for 10 minutes before serving.

6 servings, 1 1/2-inch thick slices

Per serving: 259 calories, 12 grams fat, 1 gram fiber, 436 mg. sodium

SPINACH LASAGNA

- 6 cups tomato sauce
- 1 medium onion, chopped
- 1 tablespoon olive oil
- 1 pound part skim ricotta cheese
- 1/4 cup grated Parmesan cheese
- 1/4 teaspoon pepper
- 2-3 tablespoons fresh parsley, chopped
- 1½ pounds fresh spinach, chopped and packed (2 cups) or 1 package frozen, chopped spinach, thawed and drained
- 2 garlic cloves, minced
- 2-3 tablespoons water
- 1 pound tofu, drained and crumbled
- 2 egg whites, beaten
- 6 ounce part skim Mozzarella cheese, grated
- 1 pound lasagna noodles, preferably whole wheat

1. Saute the onion and garlic in the olive oil, adding water as needed.
2. Combine the ricotta, parmesan, spinach, sauteed onion, egg whites, pepper, and parsley, mix well.
3. Cook the lasagna according to package directions.
4. Spray a 13" X 9" casserole with cooking spray. Arrange a layer of cooked noodles on the bottom, top with 1/3 of ricotta mixture, sprinkle with mozzarella, and spread with tomato sauce. Repeat layer twice more, ending with sauce.
5. Cover pan with aluminum foil, crimping edges tightly. Bake at 350 degrees for 40 minutes, remove toil and bake 10-15 minutes more.

Per serving: 215 calories, 8 grams fat, 3.5 grams fiber, 918 mg. sodium (Serves 12)

MARINATED FLANK STEAK

Flank steak is on of the leanest cuts of meat, along with top or bottom round, top sirloin, eye of round roasts, London broil, and, of course, extra lean hamburger.

- 2 pounds flank steak
- 1 tbsp. vegetable oil
- 1/2 cup dry white wine
- 1 small onion, minced
- 1 bay leaf
- 2 cloves garlic, minced
- 2 tsp. Chives, chopped
- 1/4 tsp. Thyme leaves

1. Pierce the steak with a fork on both sides at intervals of about 1 inch to tenderize.
2. In a shallow dish, combine the remaining ingredients.
3. Add the steak, turninig several times to coat with the marinade. Cover and chill in the refrigerator overnight.
4. Place the steak on a broiler pan and broil 4 minutes on each side basting with the marinade as it cooks. Use all the marinade.
5. Slice thinly on the diagonal, and serve with some of the sauce from the pan. Add salt and pepper to taste at the table, if desired.

6 servings----about 4.5 oz. Each
Per Serving: 259 calories, 9 grams fat, 1 gram fiber

BRUSSEL SPROUTS WITH CARAWAY SEEDS

1 pound Brussels sprouts (about 2 1/2 cups)
water or chicken broth
1 teaspoon caraway seeds
1/4 teaspoon salt
1/4 teaspoon pepper

1. Wash Brussels sprouts and trim wilted leaves. Make a gash in the bottom of each to speed cooking.
2. Place in 1/2 cup boiling, salted water or chicken broth. Cover and steam until fork tender. Do not overcook.
3. Pour off liquid (save as stock!). Add caraway seeds and seasonings.

Serves 4

Per serving: 45 calories, 1 gram fat, 3.5 grams fiber, 233 mg. sodium

BROCCOLI SOUP

- 1 pound broccoli, stalks separated
- 3/4 cup chopped celery
- 1 tablespoon olive oil
- 2 1/2 cups water
- 3/4 teaspoon salt
- 1/8 teaspoon nutmeg
- 2 cups water
- 1/2 cup chopped onion
- 2 tablespoons flour
- 1 tablespoon instant chicken bouillon
- 1/8 teaspoon pepper
- 1/2 cup evaporated skim milk

1. Heat 2 cups of water in a large pot till boiling.
2. Add vegetables, cover, and cook till tender (about 10 minutes).
3. Blend vegetables with part of cooking water in a blender or food processor.
4. Heat 1 tablespoon olive oil in a small nonstick skillet. Add 2 tablespoons of water and flour. Cook and stir until smooth.
5. Remove from heat add 2 1/2 cups water and heat to boiling, stirring constantly.
6. Boil and stir one minute.
7. Stir in broccoli mixture, instant bouillon, salt, pepper, and nutmeg.
8. Heat just till boiling. Stir in evaporated skim milk and heat---do not boil.

Variations: Substitute 2 pounds cauliflower with 1 tablespoon juice lemon juice for the broccoli if desired.

Serves 6.

Per serving: 86 calories, 3 grams fat, 5 grams fiber, 371 mg. sodium

OVEN "FRIED" CATFISH (Beyond filet)

1 lb. catfish fillets (or substitute other fish)
2 Tablespoon skim milk
1 egg
1/2 cup yellow cornmeal
1/4 teaspoon salt
1/4 teaspoon paprika
1/4 teaspoon onion powder
1/2 teaspoon oil

1. Preheat oven to 500 degrees.
2. Beat the milk and egg together. In another shallow bowl, combine the cornmeal and seasonings.
3. Dip each fish fillet into the egg and then coat thoroughly in the cornmeal.
4. Spray a shallow baking dish with nonstick spray and then add oil, turning to coat. Place the fish in a single layer in the baking dish.
5. Bake for about 12 minutes or until flaky.

Serves 4
Per serving: 208 calories, 6 grams fat, 0.5 grams fiber, 222 mg. sodium

EGGPLANT PARMESEAN

1 medium eggplant (about 1 lb.)
1 egg or 2 egg whites
2 tbsp. Skim milk
1/4 cup wheat germ
1/2 cup breadcrumbs
1 tbsp. Parmesan cheese
Nonstick vegetable cooking Spray
2 cups meatless Italian tomato sauce
3/4 cup part-skim mozzarella cheese

1. Slice the eggplant into 8 slices, about 1/2 inch thick. Peel if desired.
2. Beat together the egg and milk in a small, shallow bowl.
3. In another bowl, combine the wheat germ, bread crumbs, and Parmesan cheese.
4. Spray a foil-lined baking sheet with cooking spray. Dip the eggplant slices into the egg mixture, coating well. Then dip them into the bread crumb mixture. Place the "breaded" slices on the baking sheet, and bake at 350 degrees for 15 minutes. Turn the slices over and bake for another 10 minutes. Remove from oven.
5. Layer eggplant, then tomato sauce, then cheese in a casserole dish. Repeat the layers until no ingredients remain.
6. Bake covered at 350 degrees for 20 minutes, then uncover and bake 15 minutes more.

Makes 4 servings of 2 slices eggplant each, plus sauce.

SWEET AND SOUR PORK

Servings: 4

Ingredients:

1-1/4 lb Boneless pork, 1 inch cubes
1 tsp Vegetable oil
1 cup Pineapple chunks in juice
1 cup Chicken stock
2 Tbsp. Vinegar
1 Tbsp. Brown sugar
1 Tbsp. Soy sauce
1 Tbsp. Tomato paste
1/2 cup Peeled and sliced carrots
1/2 cup Green pepper strips
1/2 cup Sliced celery
1 Tbsp cornstarch
1/4 cup Water

Instructions:

Trim all visible fat from pork cubes. Brown pork cubes in oil. Drain. Drain pineapple, reserving 2 Tbsp juice. Set aside. Add stock, vinegar, brown sugar, soy sauce, tomato paste, and pineapple juice to port. Bring to a boil. Reduce heat. Cover. Simmer over medium hear for 30 minutes. Add carrots. Cover. Simmer for 15 minutes. Add green pepper and celery. Cover. Simmer for 5 minutes. Combine cornstarch and water. Mix until smooth. Add cornstarch mixture and pineapple. Stir well and cook over medium hear until thickened, 6-8 minutes. Pour into serving pans. Serve over rice.

Per Serving: 225 calories, 9 grams fat, 1 gram fiber, 610 mg sodium

Appendix O: Group Meeting Outline

Outline of Group Sessions

Week 1:	Program overview The problem of overweight and obesity Benefits of Weight Loss The importance of keeping good records
Week 2:	Nutrition Education/Learning to read nutrition labels
Week 3:	Food preparation Food shopping Eating out
Week 4:	Emotional eating
Week 5:	Relapse prevention
Week 6:	Post-treatment taste test

Appendix P: Group Leader Adherence Checklist